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**Takeuchi et al.**

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(54) **DEVELOPER ACCOMMODATING CONTAINER WITH TONER SEAL MEMBER, UNSEALING MEMBER, AND AUXILIARY UNSEALING MEMBER**

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399/262, 263  
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,969,557 A	11/1990	Oka
5,911,096 A	6/1999	Batori et al.
5,920,753 A	7/1999	Sasaki et al.
5,930,562 A	7/1999	Noda et al.
5,937,237 A	8/1999	Nonaka et al.
5,940,658 A	8/1999	Yokoi et al.

(Continued)

FOREIGN PATENT DOCUMENTS

JP	01-128352 A	9/1989
JP	02-41264 U	3/1990

(Continued)

OTHER PUBLICATIONS

Office Action in Chinese Patent Application No. 201310447382.8, mailed Dec. 22, 2015 (with English translation).

(Continued)

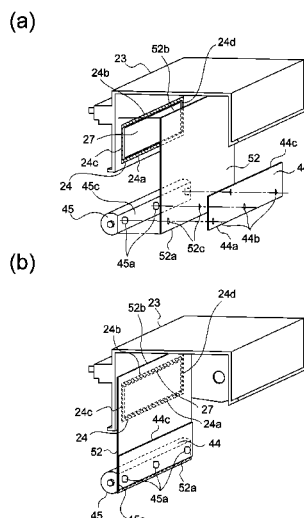
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(57) **ABSTRACT**

A developer accommodating container for accommodating a developer includes: a toner seal member for unsealably sealing an opening of the developer accommodating container; an unsealing member, connected to an end portion of the toner seal member, for unsealing the opening by moving at least a part of the toner seal member; and an auxiliary unsealing member for assisting unsealing by changing a pulling direction of the toner seal member by the unsealing member. The auxiliary unsealing member includes a shaft portion or a projected portion. The shaft portion or the projected portion extends in a longitudinal direction of the developer accommodating container.

**16 Claims, 14 Drawing Sheets**



(56)

**References Cited**

## U.S. PATENT DOCUMENTS

5,991,571 A 11/1999 Yamada et al.  
 6,075,957 A 6/2000 Batori et al.  
 6,101,348 A 8/2000 Nonaka et al.  
 6,131,007 A 10/2000 Yamaguchi et al.  
 6,275,668 B1 8/2001 Batori  
 6,334,035 B1 12/2001 Abe et al.  
 6,363,226 B1 3/2002 Batori  
 6,400,916 B1 6/2002 Go et al.  
 6,453,135 B1 9/2002 Sameshima et al.  
 6,714,746 B2 3/2004 Morioka et al.  
 6,735,405 B2 5/2004 Yokoi et al.  
 6,836,639 B2 12/2004 Karakama et al.  
 6,898,392 B2 5/2005 Karakama et al.  
 6,937,832 B2 8/2005 Sato et al.  
 6,963,706 B2 11/2005 Morioka et al.  
 6,987,938 B2 1/2006 Murakami et al.  
 7,024,131 B2 4/2006 Komatsu et al.  
 7,079,787 B2 7/2006 Ogino et al.  
 7,127,192 B2 10/2006 Batori et al.  
 7,136,604 B2 11/2006 Chadani et al.  
 7,156,797 B2 1/2007 Komatsu et al.  
 7,200,349 B2 4/2007 Sato et al.  
 7,206,534 B2 4/2007 Murakami  
 7,418,225 B2 8/2008 Morioka et al.  
 7,885,575 B2 2/2011 Batori et al.  
 7,890,019 B2 2/2011 Tateishi et al.

8,059,989 B2 11/2011 Tateishi et al.  
 8,081,898 B2 12/2011 Batori et al.  
 8,238,786 B2 8/2012 Yamaguchi et al.  
 8,326,185 B2 12/2012 Asanuma et al.  
 8,406,656 B2 3/2013 Batori et al.  
 8,422,914 B2 4/2013 Hayashi et al.  
 8,565,640 B2 10/2013 Batori et al.  
 8,620,181 B2 12/2013 Murakami  
 2008/0298834 A1\* 12/2008 Hasegawa ..... 399/106  
 2012/0294649 A1 11/2012 Kikuchi et al.

## FOREIGN PATENT DOCUMENTS

JP 05181361 A \* 7/1993  
 JP H 05-197288 8/1993  
 JP 06095506 A \* 4/1994  
 JP 06124045 A \* 5/1994  
 JP 2011-197091 A 10/2011  
 JP 2012-103287 A 5/2012

## OTHER PUBLICATIONS

Office Action in Japanese Patent Application No. 2012-213799, dated Jun. 21, 2016.

Office Action in Chinese Patent Application No. 201310447382.8, dated Jul. 27, 2016 (with English translation).

\* cited by examiner

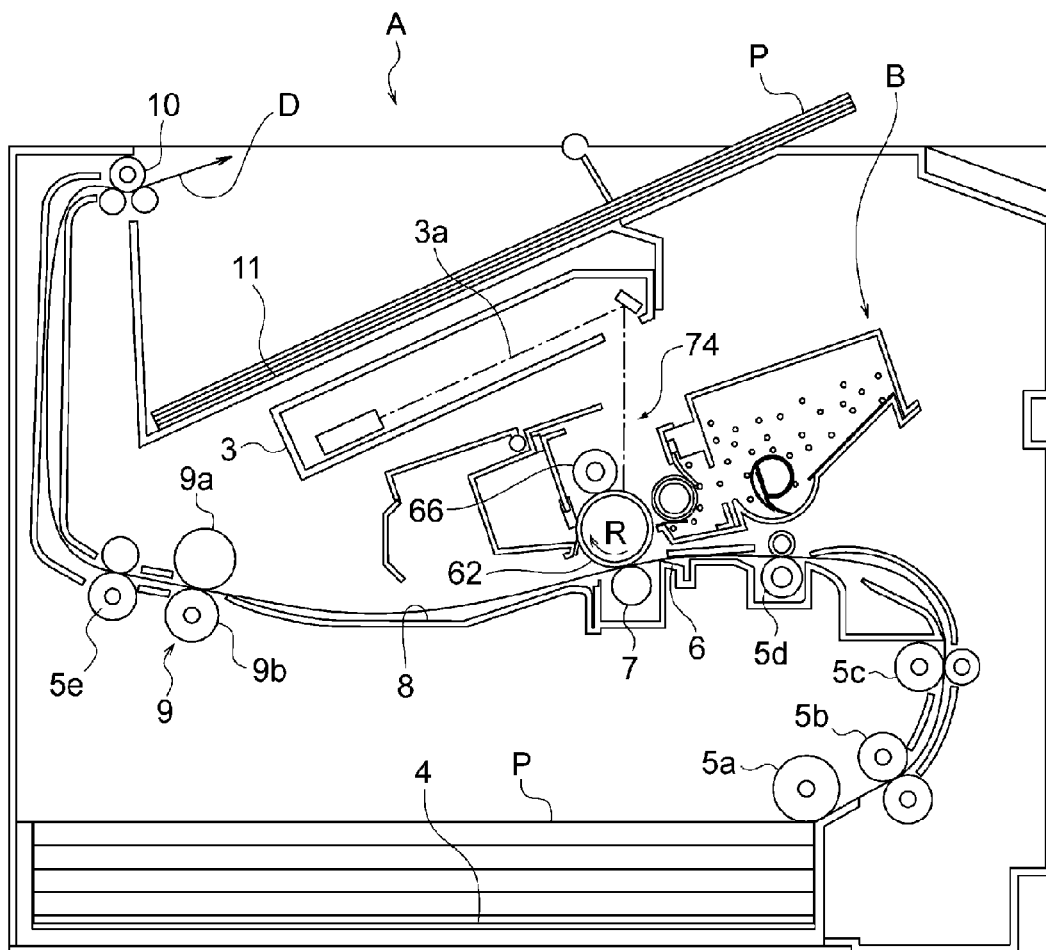


Fig. 1

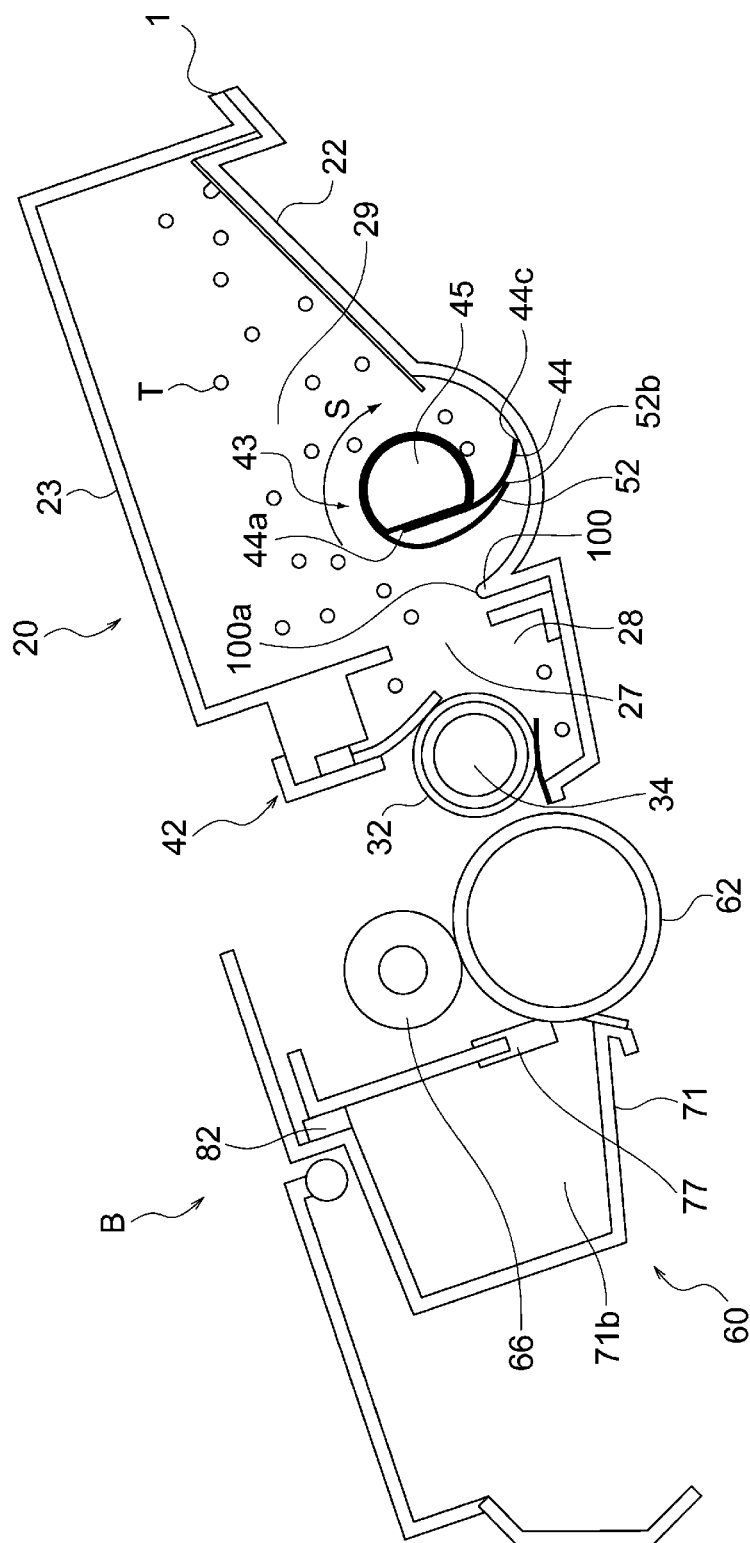


Fig. 2

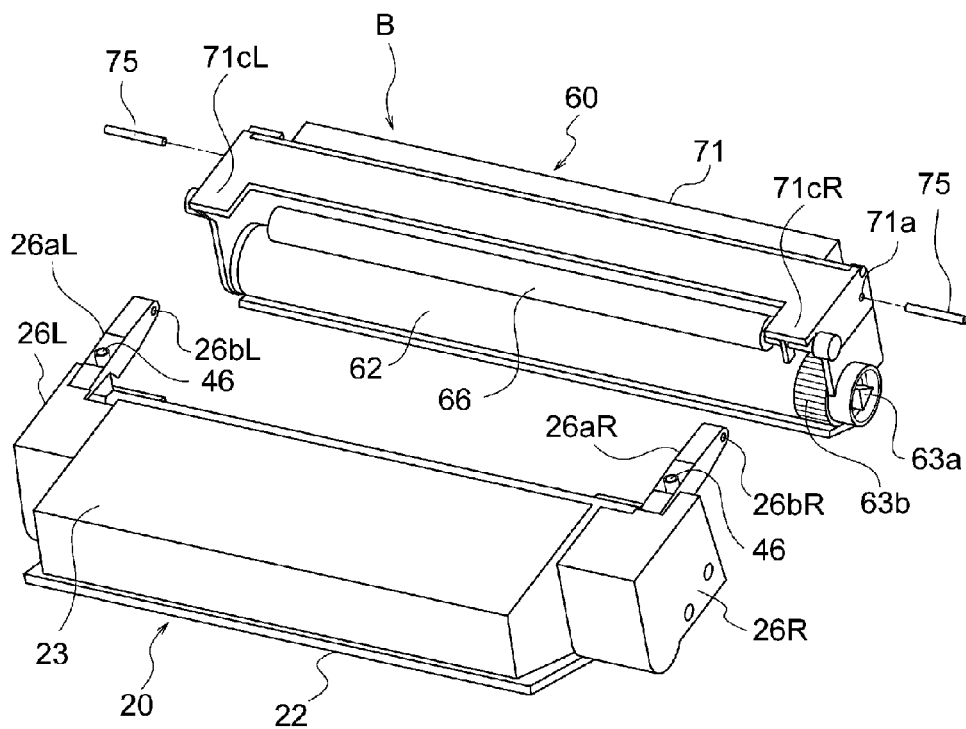


Fig. 3

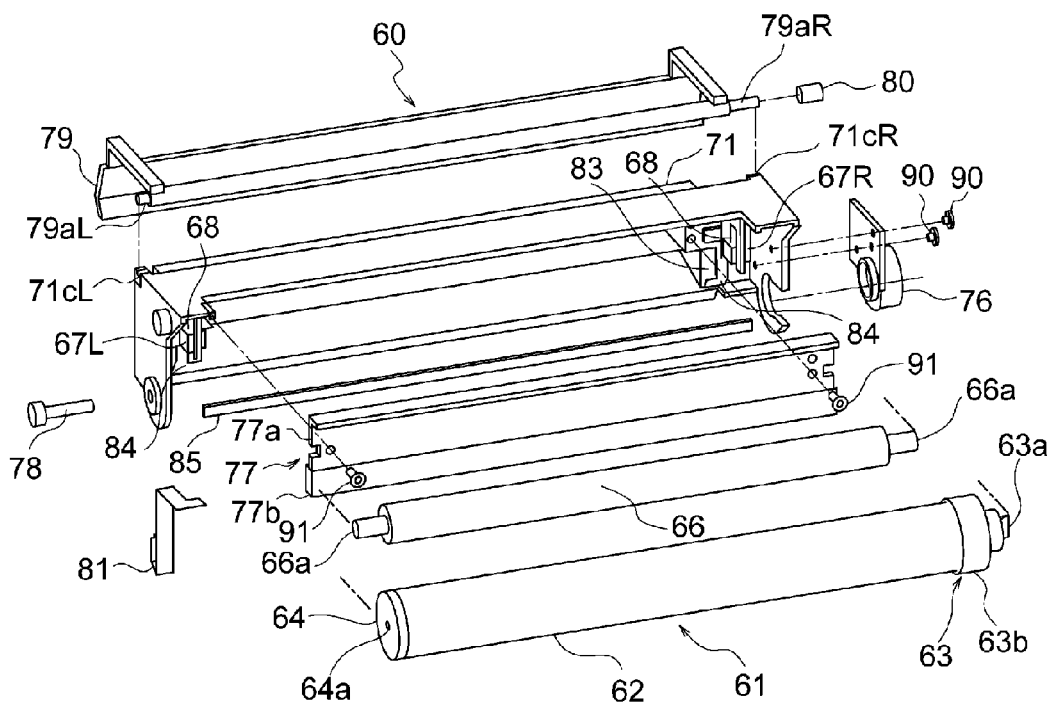


Fig. 4

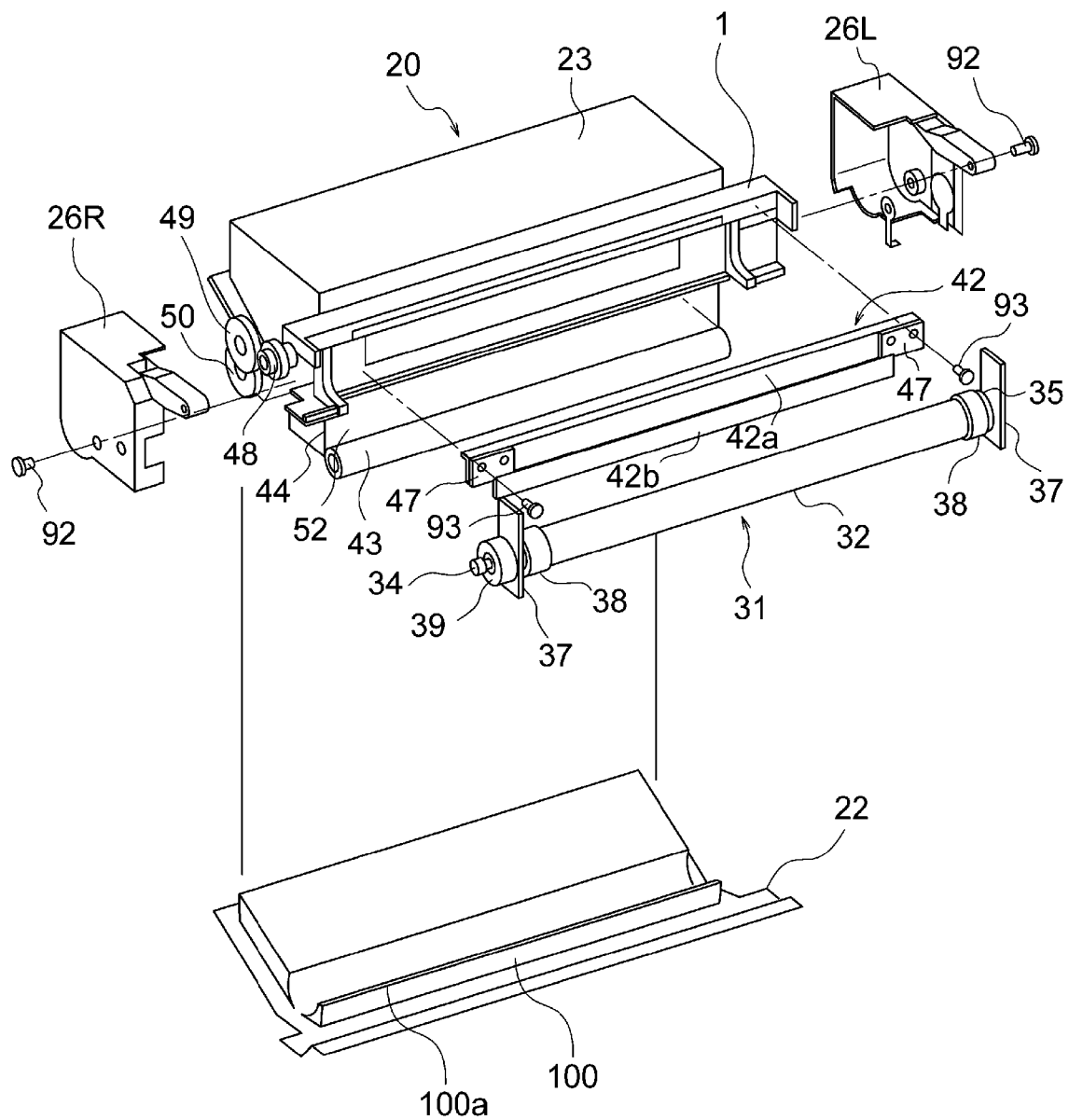
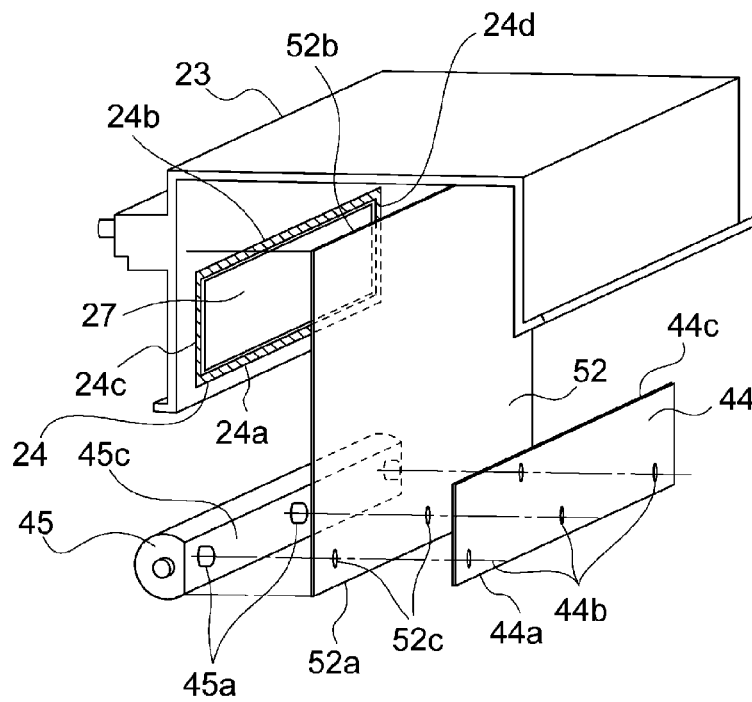


Fig. 5

(a)



(b)

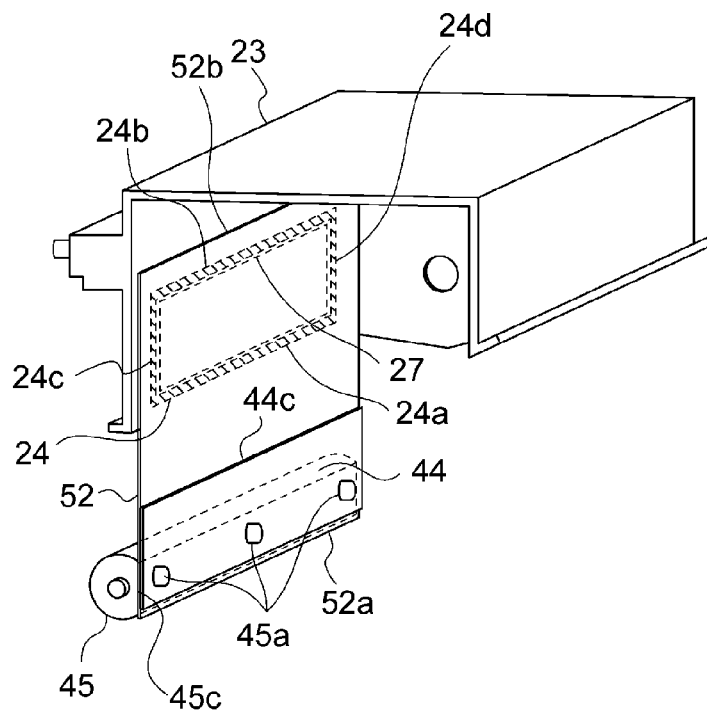


Fig. 6

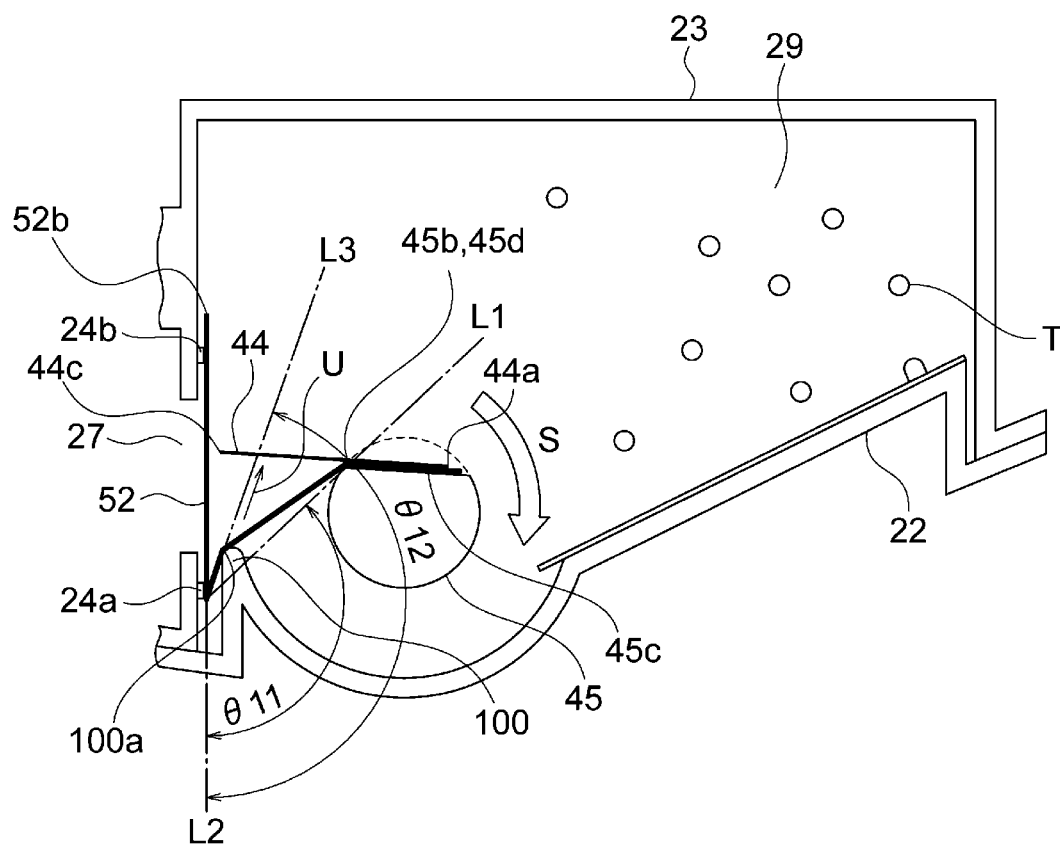


Fig. 7



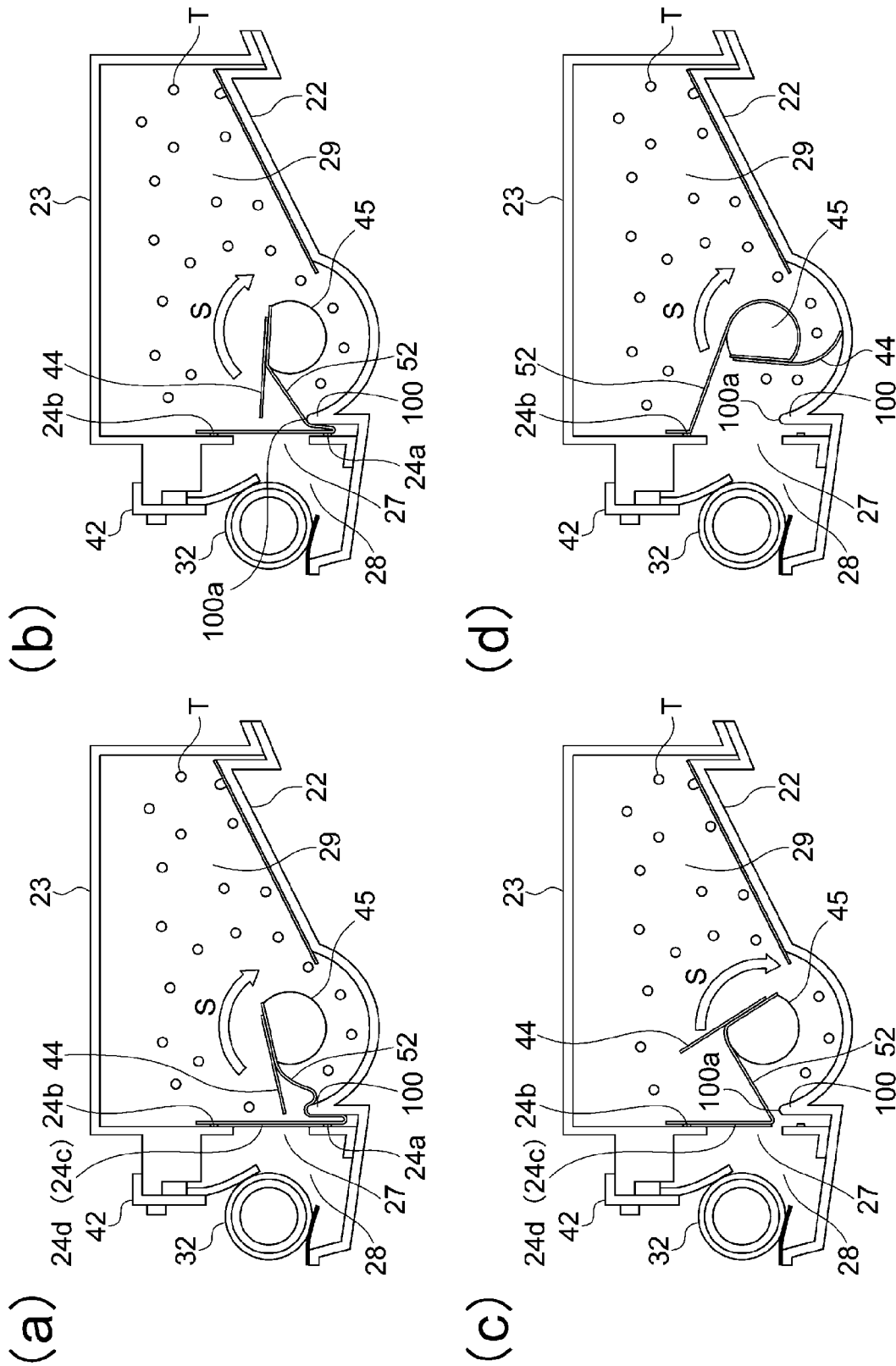


Fig. 8

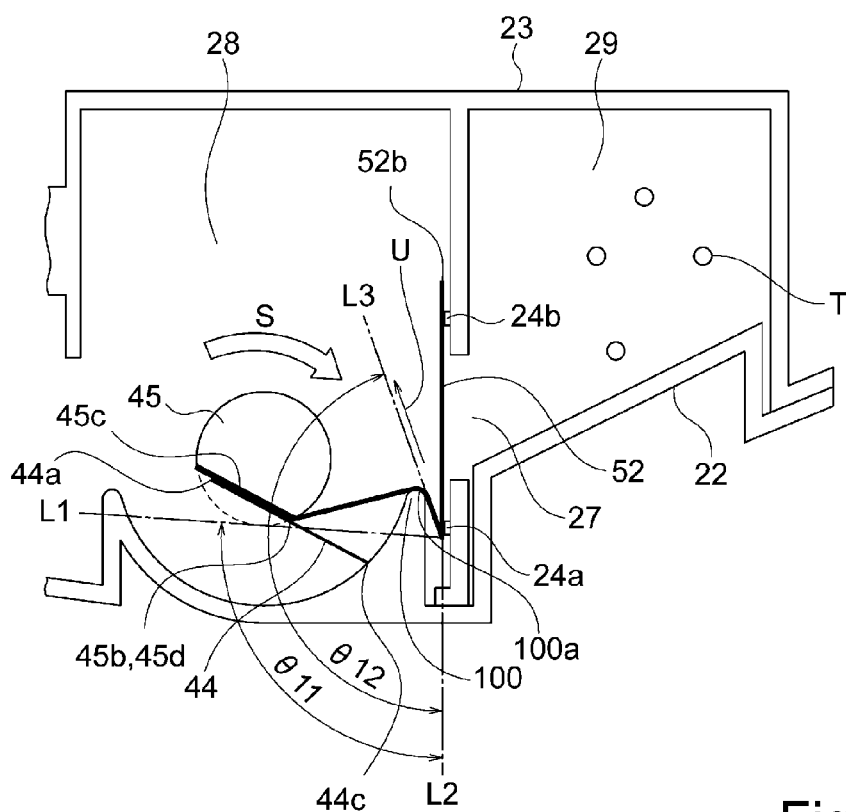


Fig. 9

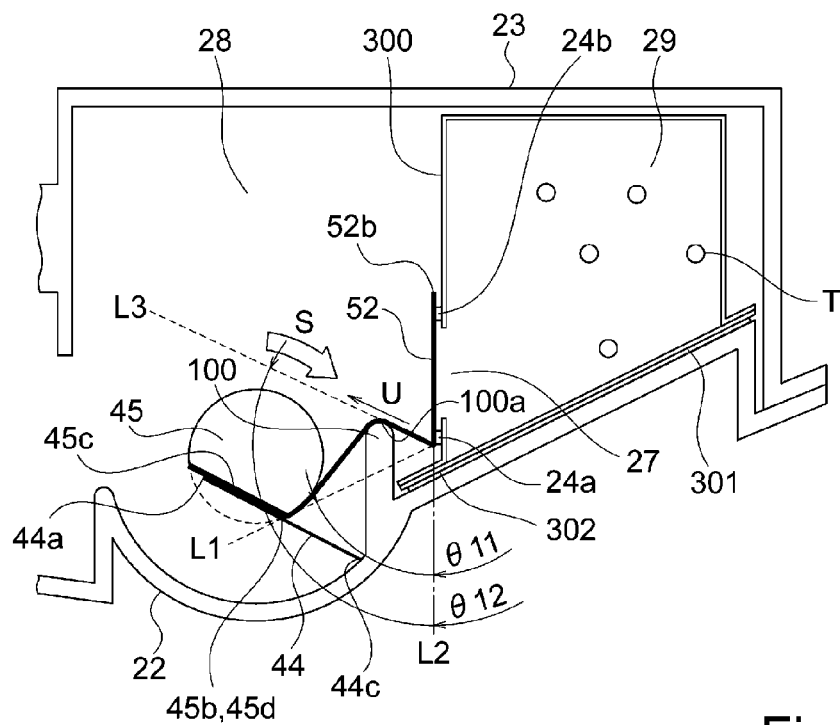


Fig. 10

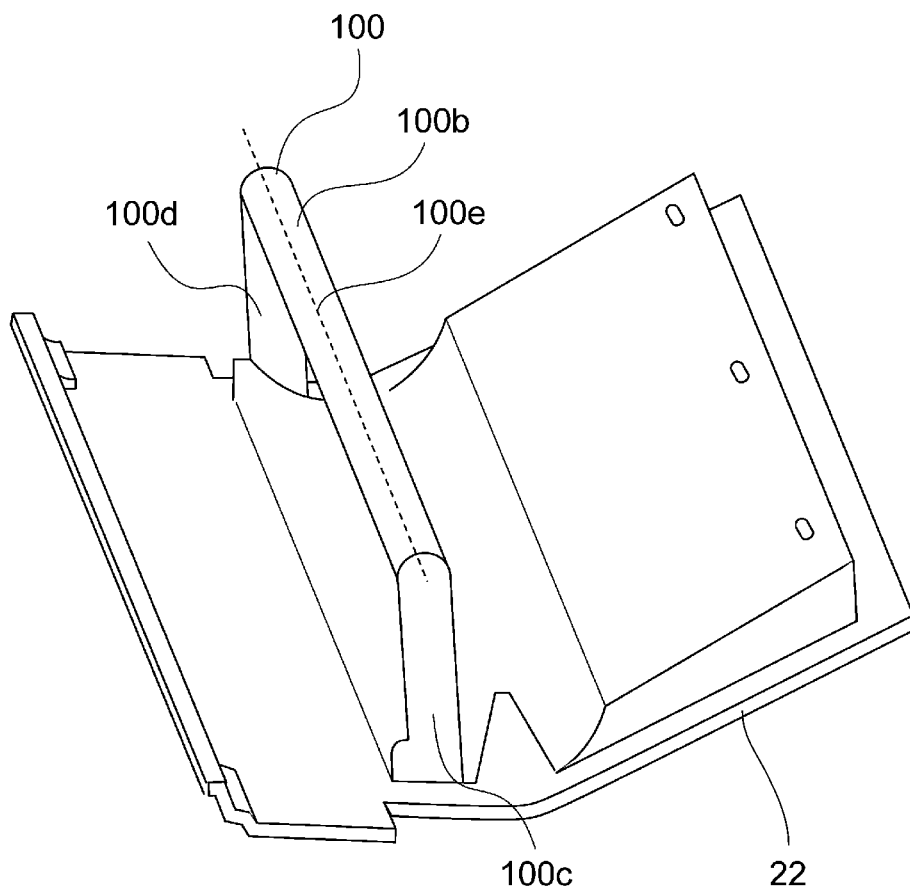


Fig. 11



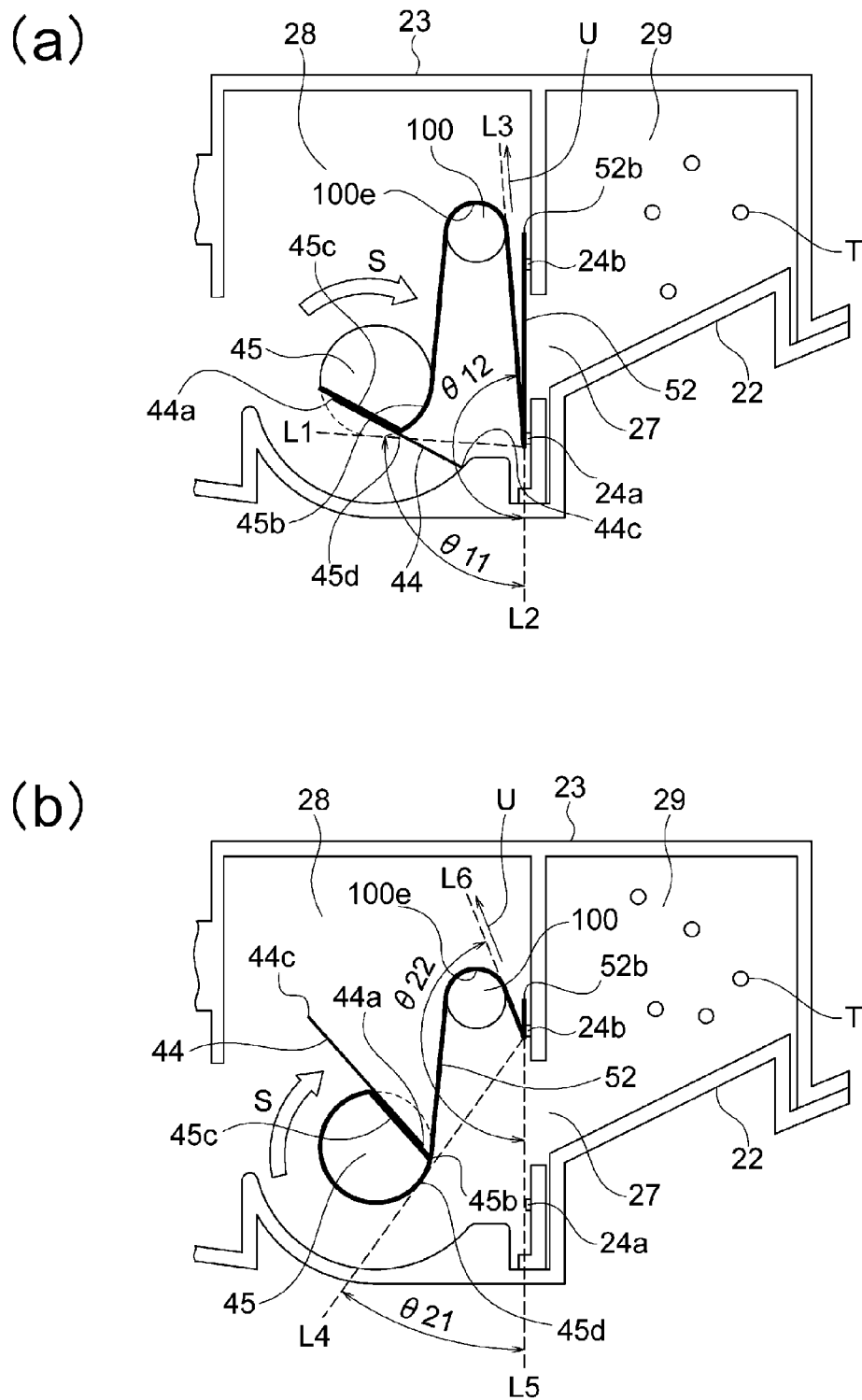
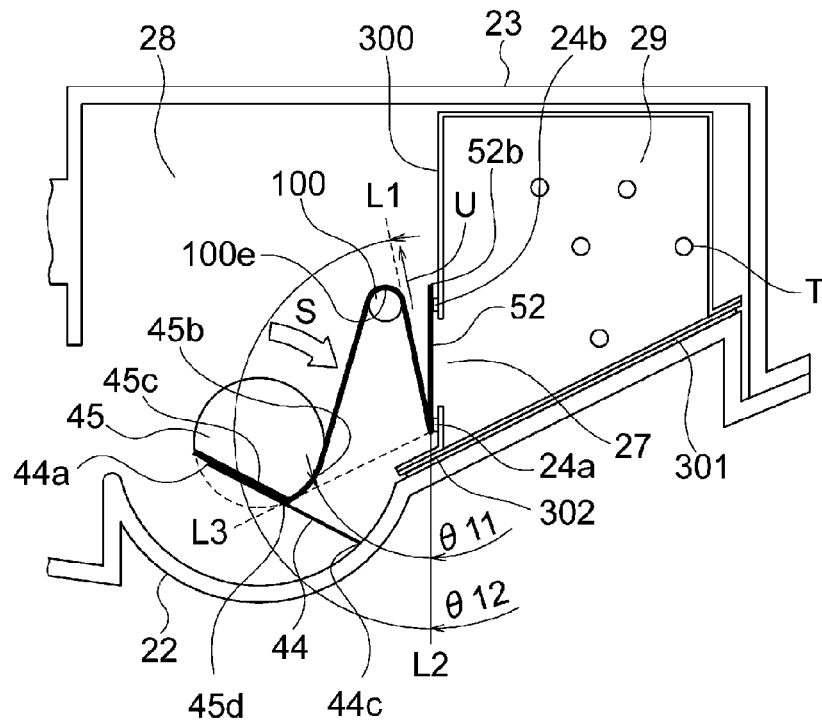


Fig. 13

(a)



(b)

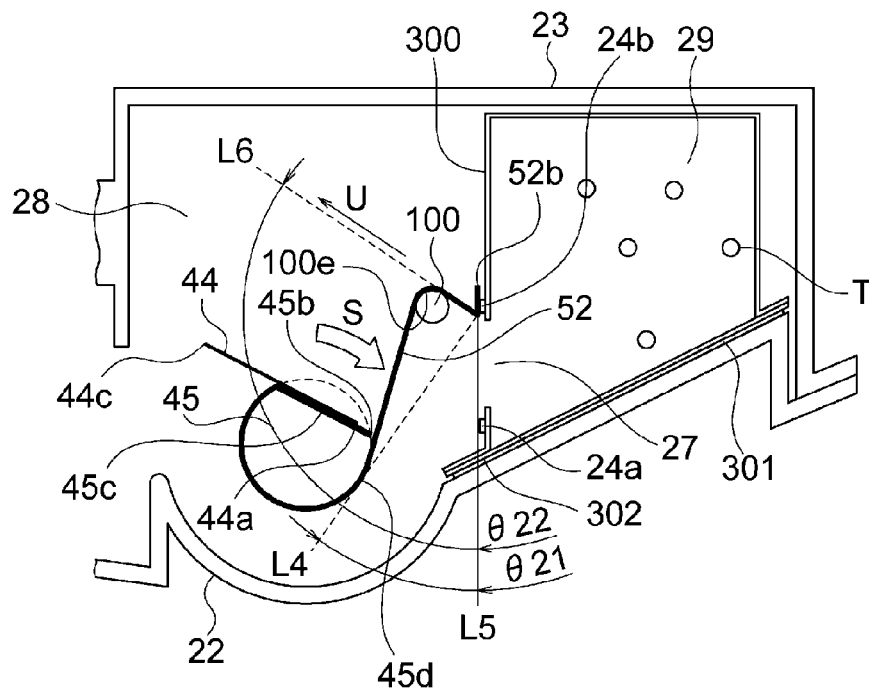
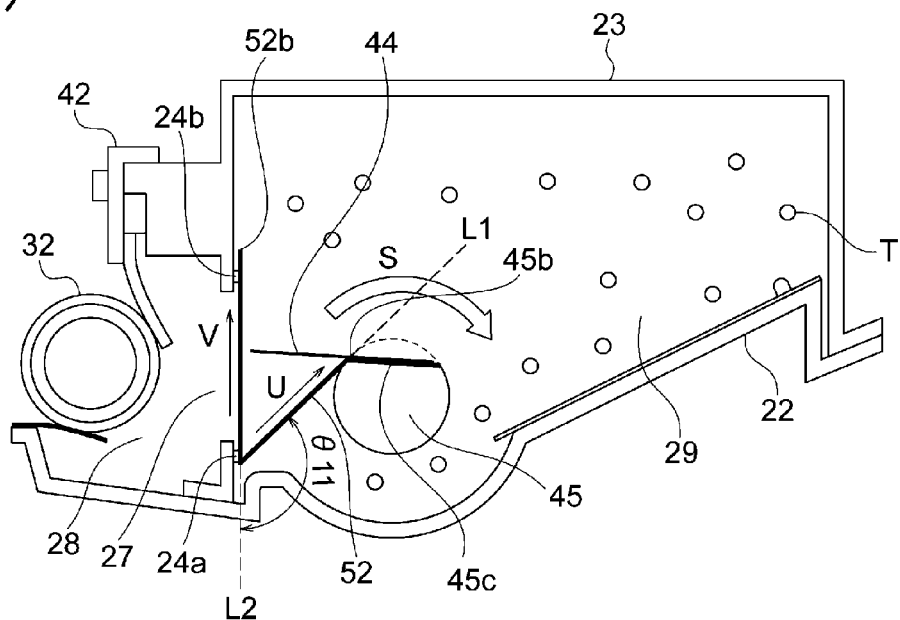


Fig. 14

(a)



(b)

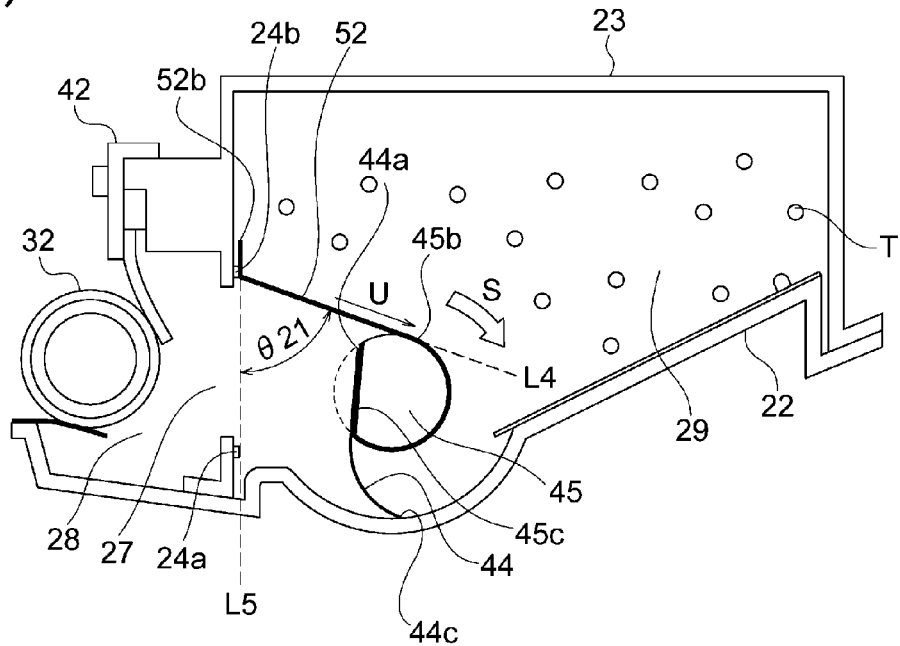


Fig. 15

PRIOR ART

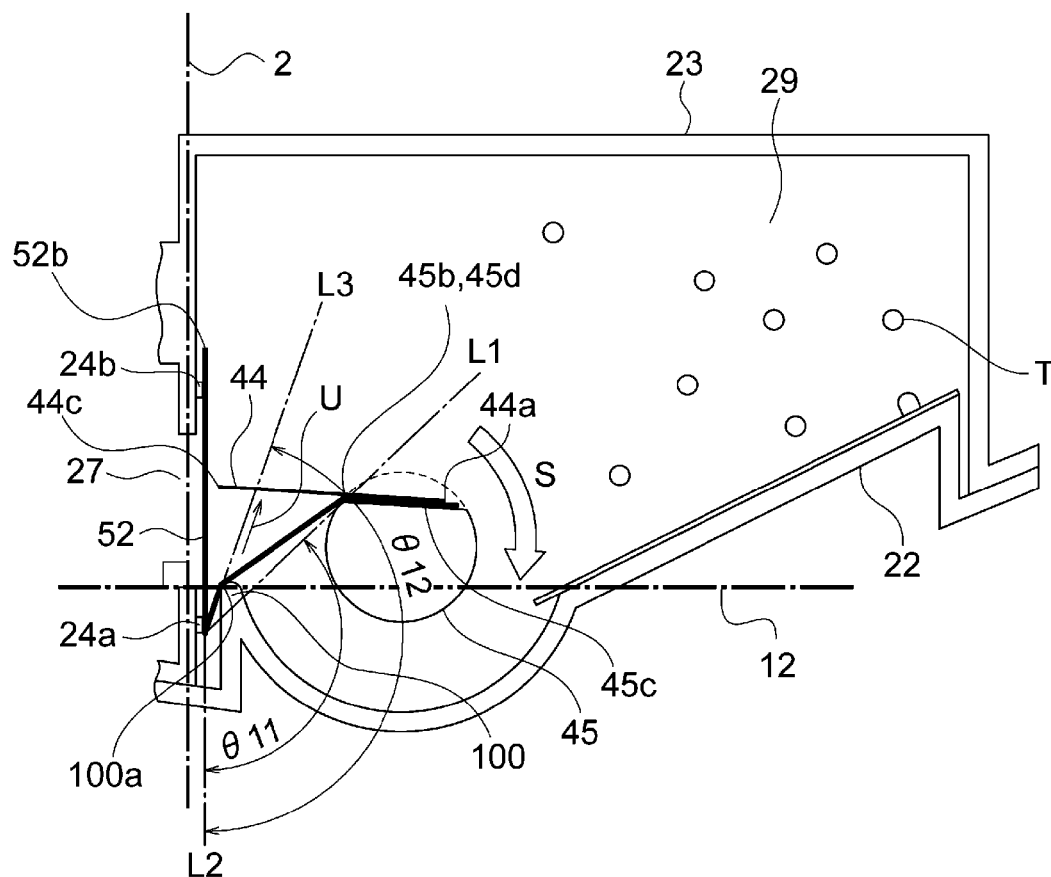


Fig. 16



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# DEVELOPER ACCOMMODATING CONTAINER WITH TONER SEAL MEMBER, UNSEALING MEMBER, AND AUXILIARY UNSEALING MEMBER

## FIELD OF THE INVENTION AND RELATED ART

The present invention relates to a developer accommodating container, a developing cartridge and a process cartridge which are to be provided in an image forming apparatus, and relates to the image forming apparatus.

As a printer, a copying machine, a facsimile machine or the like, the image forming apparatus for forming an image on a sheet material by using an electrophotographic image forming type is used.

Here, the process cartridge refers to a process cartridge prepared by integrally assembling a photosensitive drum and, as a process means, at least one of a charging device, a developing device and a cleaning device into a cartridge. Then, this process cartridge is detachably mounted into a main assembly of the image forming apparatus.

The image forming apparatus using the electrophotographic image forming type forms an electrostatic latent image by subjecting the photosensitive drum, which surface is uniformly electrically charged by a charging means, to selective exposure to light depending on image information. Then, the electrostatic latent image is developed with a toner by a developing means, so that a toner image is formed. Thereafter, the toner image formed on the surface of the photosensitive drum is transferred onto the sheet material to effect image formation.

For example, Japanese Laid-Open Patent Application (JP-A) Hei 5-197288 discloses that a toner supplying opening for permitting communication between a toner chamber and a toner supplying chamber is sealed by using a toner seal member, and then the toner seal member is unsealed by a rotatable member.

The unsealing of the toner seal member is performed by automatically winding up the toner seal member, around the rotatable member, mounted at an end thereof on the rotatable member in the toner chamber. After the unsealing of the toner seal member, the toner seal member is rotated integrally with the rotatable member.

As a result, it is possible to prevent leakage of the toner caused by vibration or impact during transportation of the process cartridge. The toner seal member remains in the process cartridge, and therefore there is no need for a user to treat the toner seal member. Further, there is no need for the user to unseal the toner seal member, and therefore usability (ease of use) is improved.

However, in a constitution of JP-A Hei 5-197288, there was the following problem.

For example, as in a reference example shown in FIG. 15, a toner supplying chamber 28 is provided between a toner chamber 29 provided in a developing container 23 and a toner supplying chamber 28 where a developing roller 32 is provided. Further, of a sealing portion of a toner seal member 52 for sealing the toner supplying opening 28, an upstreammost portion of the toner seal member 52 with respect to an unseal direction V is a sealing portion 24a, and a downstreammost portion of the toner seal member 52 with respect to the unsealing direction V is a sealing portion 24b.

As shown in (a) of FIG. 15, during peeling of the sealing portion 24a of the toner seal member 52, a tangential line of the toner seal member 52 which includes the sealing portion 24a as its end point and which contacts an outer peripheral

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surface 45b of a rotatable member 45 is a first rectilinear line L1. Further, on a rectilinear line passing through the sealing portions 24a and 24b, a rectilinear line which includes the sealing portion 24a as its end point and which extends in a direction opposite from the sealing portion 24b (in a downward direction of (a) of FIG. 15) is a second rectilinear line L2. Further, a narrower angle of angles formed between the first rectilinear line L1 and the second rectilinear line L2 is  $\theta 11$ .

Further, as shown in (b) of FIG. 15, during the peeling of the sealing portion 24b of the toner seal member 52, a tangential line of the toner seal member 52 which includes the sealing portion 24b as its end point and which contacts an outer peripheral surface 45b of a rotatable member 45 is a fourth rectilinear line L4. Further, on a rectilinear line passing through the sealing portions 24a and 24b, a rectilinear line which includes the sealing portion 24b as its end point and which passes through the sealing portion 24a is a fifth rectilinear line L5. Further, a narrower angle of angles formed between the fourth rectilinear line L4 and the fifth rectilinear line L5 is  $\theta 21$ .

Here, in general, when the angles  $\theta 11$  and  $\theta 21$  shown in FIG. 15 are increased, the toner seal member 52 can be peeled with a small peeling force. Accordingly, the rotatable member 45 is driven with a minimum force so as to provide a smaller peeling force U for peeling the toner seal member from the sealing portions 24a and 24b. In that case, there is a need to dispose the rotatable member 45 in a higher position so as to provide larger angles  $\theta 11$  and  $\theta 21$  shown in FIG. 15.

However, in the case where the rotatable member 45 is disposed in the higher position so as to provide the larger angles  $\theta 11$  and  $\theta 21$  shown in FIG. 15, there is a possibility that a function of the rotatable member 45 as a stirring and feeding member for feeding a toner T from the toner chamber 29 to the toner supplying chamber 28 while stirring the toner T is lowered.

## SUMMARY OF THE INVENTION

The present invention has solved the above-described problem, and a principal object of the present invention to provide a developer accommodating container capable of improving a degree of freedom of arrangement of an unsealing member for unsealing an opening by moving a toner seal member.

According to an aspect of the present invention, there is provided a developer accommodating container for accommodating a developer, comprising: a toner seal member for unsealably sealing an opening of the developer accommodating container; an unsealing member, connected to an end portion of the toner seal member, for unsealing the opening by moving at least a part of the toner seal member; and an auxiliary unsealing member for assisting unsealing by changing a pulling direction of the toner seal member by the unsealing member, wherein the auxiliary unsealing member includes a shaft portion or a projected portion, and wherein the shaft portion or the projected portion extends in a longitudinal direction of the developer accommodating container.

These and other objects, features and advantages of the present invention will become more apparent upon a consideration of the following description of the preferred embodiments of the present invention taken in conjunction with the accompanying drawings.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a sectional illustration showing a structure of an image forming apparatus in which a process cartridge also

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functioning as a developing cartridge including a developer accommodating container according to the present invention in Embodiment 1 is provided.

FIG. 2 is a sectional illustration showing a structure of the process cartridge in Embodiment 1.

FIG. 3 is an exploded perspective view showing the structure of the process cartridge in Embodiment 1.

FIG. 4 is an exploded perspective view showing a structure of a cleaning unit in Embodiment 1.

FIG. 5 is an exploded perspective view showing a structure of the developing unit in Embodiment 1.

Parts (a) and (b) of FIG. 6 are an exploded perspective view and a perspective illustration, respectively, showing a structure of a sealing portion for sealing an opening by a toner seal member in Embodiment 1.

FIG. 7 is a sectional illustration showing a state of the toner seal member during unsealing of the toner seal member in Embodiment 1.

Parts (a) to (d) of FIG. 8 are sectional views for illustrating an unsealing operation of the toner seal member in Embodiment 1.

FIG. 9 is a sectional illustration showing a state, during unsealing of a toner seal member, of a process cartridge also functioning as a developing cartridge including a developer accommodating container according to the present invention in Embodiment 2.

FIG. 10 is a sectional illustration showing a state, during unsealing of a toner seal member, of a process cartridge also functioning as a developing cartridge including a developer accommodating container according to the present invention in Embodiment 3.

FIG. 11 is a perspective view for illustrating a structure of an auxiliary unsealing member of a process cartridge also functioning as a developing cartridge including a developer accommodating container according to the present invention in Embodiment 4.

Parts (a) and (b) of FIG. 12 are sectional illustrations showing a state of a toner seal member during unsealing of the toner seal member in Embodiment 4.

Parts (a) and (b) of FIG. 13 are sectional illustrations showing a state, during unsealing of a toner seal member, of a process cartridge also functioning as a developing cartridge including a developer accommodating container according to the present invention in Embodiment 5.

Parts (a) and (b) of FIG. 14 are sectional illustrations showing a state, during unsealing of a toner seal member, of a process cartridge also functioning as a developing cartridge including a developer accommodating container according to the present invention in Embodiment 6.

Parts (a) and (b) of FIG. 15 are sectional illustrations showing a state of a toner seal member during unsealing of the toner seal member in a reference example.

FIG. 16 is a sectional illustration showing a state in which an opening, an auxiliary unsealing member and an unsealing member are located in this order on a line perpendicular to a phantom plane including the opening.

#### DESCRIPTION OF THE PREFERRED EMBODIMENTS

With reference to the drawings, embodiments of an image forming apparatus in which a process cartridge also functioning as a developing cartridge including a developer accommodating container according to the present invention is provided will be described specifically.

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[Embodiment 1]

First, a structure of the image forming apparatus in which the process cartridge also functioning as the developing cartridge including the developer accommodating container according to the present invention is provided in this embodiment will be described with reference to FIGS. 1 to 18. Incidentally, in the following description, a rotational axis direction (left-right direction in FIG. 3) of a photosensitive drum 62 as an image bearing member for forming an electrostatic latent image on a surface of the photosensitive drum 62 is referred to as a longitudinal direction.

Further, with respect to the longitudinal direction of the photosensitive drum 62 shown as the left-right direction in FIG. 3, a side (right side in FIG. 3) where the photosensitive drum 62 receives a driving force from a main assembly of an image forming apparatus A is referred to as a driving side (a driving force receiving portion 63a side shown in FIG. 4), and its opposite side is referred to as a non-driving side.

A general structure of the image forming apparatus A and an image forming process will be described with reference to FIGS. 1 and 2.

FIG. 1 is a sectional view of a main assembly of the image forming apparatus A and a process cartridge B. FIG. 2 is a sectional view of the cartridge B. Here, the main assembly of the image forming apparatus A refers to a portion of the image forming apparatus A from which the cartridge B is removed.

<General Structure of Image Forming Apparatus>

In FIG. 1, the image forming apparatus A is a laser beam printer, using an electrophotographic type, in which the cartridge B is detachably mountable to the main assembly of the image forming apparatus A. When the cartridge B is mounted in the main assembly of the image forming apparatus A, above the process cartridge B, an exposure device 3 consisting of a laser scanner unit is provided.

Further, below the cartridge B, a sheet (feeding) tray 4 in which a sheet material P to be subjected to image formation is accommodated is provided.

Further, in the main assembly of the image forming apparatus A (in the image forming apparatus main assembly), along a conveyance direction D of the sheet material P, a pick-up roller 5a, a feeding roller 5b, a conveying roller 5c, a registration roller 5d, a transfer guide 6, a transfer roller 7 as a transfer means and a conveying guide 8 are provided. Further, a fixing device 9 as a fixing means, a conveying roller 5e, a discharging roller 10, a discharge tray 11 and the like are successively provided. Incidentally, the fixing device 9 is constituted by including a heating roller 9a and a pressing roller 9b.

<Image Forming Process Operation>

Next, an image forming process operation will be described. On the basis of a print start signal, the photosensitive drum 62 is rotationally driven at a predetermined peripheral speed (process speed) in an arrow R direction in FIG. 1.

A charging roller 66 as a charging means to which an unshown charging bias voltage is applied contacts the outer peripheral surface of the photosensitive drum 62 and electrically charges the outer peripheral surface of the photosensitive drum 62 uniformly.

The exposure device 3 as an exposure means outputs laser light 3a depending on image information. The laser light 3a passes through an exposure window portion 74 provided at an upper surface of the cartridge B, so that the outer peripheral surface of the photosensitive drum 62 is subjected to scanning exposure. As a result, on the outer peripheral

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surface of the photosensitive drum 62, an electrostatic latent image depending on the image information is formed.

On the other hand, as shown in FIG. 2, in a developing container 23, as a developer accommodating container for accommodating the toner T as the developer, provided in a developing unit 20 as the developing device, a toner chamber 29 for accommodating the toner T is provided. The toner T in the toner chamber 29 is stirred and fed by rotation of a feeding member 43. Then, the toner T is sent to a toner supplying chamber 28 as a toner chamber outside portion including a rectangular toner supplying opening 27 as an opening communicating with the toner chamber 29.

The sheet member 43a is formed in a flexible sheet shape. The sheet member 43a is constituted by a material such as polyphenylene sulfide (PPS), polycarbonate (PC) or polyethylene terephthalate (PET). By the integral rotation of the sheet member 43a with the feeding member 43, stirring of the toner T in the toner chamber 29 and feeding of the toner T into the toner supplying chamber 28 are effected.

The toner T is carried by a magnetic force of a magnet roller 34 formed with a fixed magnet, on a surface of a developing roller 32 as a developer carrying member for supplying the toner T, in the toner supplying chamber 28 (developer accommodating container) of the developing container 23, to the surface of the photosensitive drum 62.

The toner T carried on the surface of the developing roller 32 is regulated in layer thickness by a developing blade 42 while being triboelectrically charged.

The toner T carried on the developing roller 32 is transferred onto the photosensitive drum 62 depending on the electrostatic latent image formed on the surface of the photosensitive drum 62, so that the electrostatic latent image is visualized as a toner image.

Further, as shown in FIG. 1, in synchronism with output timing of the laser light 3a, by the pick-up roller 5a, the feeding roller 5b and the conveying roller 5c, the sheet material P accommodated at a lower portion of the main assembly of the image forming apparatus A is fed and conveyed from the sheet tray 4.

Then, by the registration roller 5d, the sheet material P is conveyed, in synchronism with the toner image formed on the surface of the photosensitive drum 62, to a transfer position between the photosensitive drum 62 and the transfer roller 7 via the transfer guide 6. In this transfer position, the toner image formed on the surface of the photosensitive drum 62 is successively transferred onto the sheet material P.

The sheet material P on which the toner image is transferred is separated from the photosensitive drum 62 and then is conveyed to the fixing device 9 along the conveying guide 8. Then, the sheet material P passes through a fixing nip between the heating roller 9a and the pressing roller 9b which constitute the fixing device 9.

At this fixing nip, fixing by heating and pressure application is effected, so that the toner image is fixed on the sheet material P. The sheet material P on which the toner image is fixed is conveyed to the discharging roller 10 by the conveying roller 5e and then is discharged onto the discharge tray 11.

On the other hand, as shown in FIG. 2, the surface of the photosensitive drum 62 after the toner image is transferred onto the sheet material P is, after from which a residual toner is removed by a cleaning blade 77, used again in the image forming process operation. The residual (waste) toner removed from the photosensitive drum 62 is stored in a residual toner chamber 71b of a cleaning unit 60.

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In the above-described constitution, the charging roller 66, the developing roller 32, and the cleaning blade 77 are the image forming process means actable on the photosensitive drum 62.

#### <General Structure of Cartridge>

Next, with respect to FIGS. 2, 3 and 5, a general structure of the cartridge B will be described. FIG. 3 is a perspective view for illustrating a structure of the cartridge B. As shown in FIGS. 2 and 3, the cartridge B is constituted by combining the cleaning unit 60 and the developing unit 20. The cleaning unit 60 is constituted by including a cleaning frame 71, the photosensitive drum 62, the charging roller 66, the cleaning blade 77 and the like.

On the other hand, the developing unit 20 is constituted by including the developer container 23, a bottom member 22, (left and right) side members 26L and 26R, a developing blade 42, the developing roller 32, the magnet roller 34, the feeding member 43, the toner T, an urging member 46, and the like.

Then, the cleaning unit 60 and the developing unit 20 are rotationally movably connected with each other by a pin-like connecting member 75 shown in FIG. 3, so that the cartridge B is constituted.

Specifically, the side members 26L and 26R are provided at end portions of the developing unit 20 with respect to a longitudinal direction of the developing unit 20 (a rotational axis direction of the developing roller 32). Further, arm portions 26aL and 26aR formed on the side members 26L and 26R, respectively, are provided with rotational movement holes 26bL and 26bR, respectively at their end portions, in parallel to a rotation shaft of the developing roller 3.

Further, at each of longitudinal end portions of the cleaning frame 71, an engaging hole 71a for permitting engagement therein of the pin-like connecting member 75 is formed and disposed in parallel to a rotation shaft of the photosensitive drum 62.

Then, the arm portions 26aL and 26aR are engaged with the cleaning frame 71 at the longitudinal end portions of the cleaning frame 71, and then the connecting members 75 are inserted into the rotational movement holes 26bL and 26bR and the engaging holes 71a, thus being locked. As a result, the cleaning unit 60 and the developing unit 20 are connected with each other rotatably about the connecting members 75.

At this time, urging members 46 mounted at base portions of the arm portions 26aL and 26aR about against abutment portions 71cL and 71cR provided at longitudinal end portions of the cleaning frame 71. Further, the urging members 46 urge, by its urging force, the developing unit 20 rotatably about the connecting members 75 toward the cleaning unit 60. As a result, the developing roller 32 is pressed toward the photosensitive drum 62 with reliability.

Then, by a gap (spacing) holding member 38 mounted at each of the end portions of the developing roller 32 with respect to the rotational axis direction of the developing roller 32 shown in FIG. 5, the developing roller 32 is held with a predetermined gap from the photosensitive drum 62.

<Cleaning Unit>  
Next, with reference to FIGS. 2 and 4, a structure of the cleaning unit 60 will be described. FIG. 4 is an exploded perspective view for illustrating the structure of the cleaning unit 60.

In FIG. 4, the cleaning unit 60 is constituted by including a supporting member 77a formed with a metal plate and an elastic member 77b formed of an elastic material such as urethane rubber. Further, the cleaning blade 77 is fixed on

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the cleaning frame 71 by inserting screws 91 into through holes provided at longitudinal end portions of the supporting member 77a, thus being provided in a predetermined position.

The elastic member 77b of the cleaning blade 77 contacts the surface of the photosensitive drum 62, so that the residual toner is scraped off and removed from the surface of the photosensitive drum 62.

The residual toner removed from the surface of the photosensitive drum 62 is stored in the residual toner container 71b provided in the cleaning unit 60 shown in FIG. 2.

An electrode plate 81, an urging member 68 and charging roller bearings 67L and 67R which are shown in FIG. 4 are mounted on the cleaning frame 71. A rotation shaft 66a of the charging roller 66 is rotatably engaged into and supported by the charging roller bearings 67L and 67R.

The charging roller 66 is urged toward the photosensitive drum 62 by the urging member 68, and is rotatably supported by the charging roller bearings 67L and 67R. Then, the charging roller 66 is rotated by rotation of the photosensitive drum 62.

The photosensitive drum 62 is connected integrally with flanges 63 and 64 and thus is constituted as a photosensitive drum unit 61. This connecting method can be performed by using caulking, bonding, welding or the like.

To the flange 64, an unshown grounding contact and the like are connected. Further, the flange 63 includes a driving force receiving portion 63a for receiving a driving force from the main assembly of the image forming apparatus A and includes a flange gear portion 63b for transmitting the driving force to the developing roller 32.

The bearing member 76 is integrally fixed on the cleaning frame 71 in the driving side, and the drum shaft 78 is press-fitted and fixed in the cleaning frame 71 in the non-driving side. Further, the bearing member 76 is engaged with the flange 63, and a drum shaft 78 is engaged with a hole 64a of the flange 64. As a result, the photosensitive drum unit 61 is rotatably supported by the cleaning frame 71.

<Developing Unit>

Next, a structure of the developing unit 20 will be described with reference to FIGS. 2 and 3 to 5. FIG. 5 is an exploded perspective view for illustrating a structure of the developing unit 20.

As shown in FIGS. 2 and 5, a developing (device) frame 1 consisting of the toner developing container 23 and the bottom member 22 defines the toner chamber 29 in which the toner T is accommodated, and the toner supplying chamber 28 which are shown in FIG. 2. The developing container 23 and the bottom member 22 are integrally connected with each other by welding or the like.

The feeding member 43 is constituted by including a feeding sheet 44 and the rotatable member 45. The rotatable member 45 is a rotatable member capable of stirring the toner T in the toner chamber 29 and is constituted as an unsealing member for unsealing the toner supplying opening 27 by moving the toner seal member 52 for unsealably sealing the toner supplying opening 27.

The feeding member 43 is rotatably supported by the developing container 23 in the non-driving side, and is fixed to a feeding gear 50 rotatably mounted in the driving side. As a result, the feeding member 43 is rotated in the toner chamber 29 by the rotation of the feeding gear 50.

The developing blade 42 is constituted by including a supporting member 42a formed with a metal plate and including an elastic member 42b formed of an elastic material such as an urethane rubber. Further, the developing

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blade 42 is fixed together with a cleaning member 47 in a predetermined position relative to the developing container 23 by inserting screws 93 into through holes provided at longitudinal end portions of the supporting member 42a.

A developing roller unit 31 is constituted by including the developing roller 32, the magnet roller 34, a flange 35, the gap holding member 38, a bearing member 37, a developing roller gear 39 and the like.

From an end portion of the opening in the non-driving side (the right side of FIG. 5), the magnet roller 34 is inserted, and at the opening end portion in the non-driving side, the flange 35 is press-fitted and fixed.

The gap holding member 38 is mounted at each of the end portions of the developing roller 32 with respect to the rotational axis direction of the developing roller 32. Further, outside the gap holding member 38, the bearing member 37 is disposed, and in the driving side (left side of FIG. 5), the developing roller gear 39 is assembled outside the bearing member 37.

By the bearing member 37 disposed at each of the end portions of the developing roller 32 with respect to the rotational axis direction of the developing roller 32, the developing roller 32 is rotatably supported.

Gears 48 and 49 as a drive transmission member are rotatably engaged with the developing frame 1. As a result, the rotational driving force from the main assembly of the image forming apparatus A is received by the driving force receiving portion 63a shown in FIG. 3. The driving force received by the driving force receiving portion 63a is transmitted to the developing roller 32 and the feeding member 43 by successive engagement and rotation of the flange gear portion 63b shown in FIGS. 3 and 4, the developing roller gear 39, the gears 48 and 49, and the feeding gear 50.

As shown in FIG. 5, the side members 26L and 26R are fixed with screws 92 at end portions, respectively, of the developing frame 1 with respect to the longitudinal direction of the developing frame 1. At that time, the bearing members 37 of the developing roller unit 31 are held by the side members 26L and 26R.

<<Toner Seal Member, Auxiliary Unsealing Member and Unsealing Operation>>

<Structure of Toner Seal Member and Auxiliary Unsealing Member>

Next, with reference to FIGS. 6 to 8, a structure of the toner seal member 52 for unsealably sealing the toner supplying opening 27 will be described. Parts (a) and (b) of FIG. 6 are perspective views for illustrating a sealing structure of the toner supplying opening 27 by the toner seal member 52. FIG. 7 is a sectional illustration showing a state of the toner seal member 52 during unsealing of the toner seal member 52. Parts (a) to (d) of FIG. 8 are sectional illustrations showing an unsealing operation of the toner seal member 52.

As shown in FIGS. 6 to 8, the developing container 23 is provided with the toner supplying opening 27 for establishing communication between the toner chamber 29 and the toner supplying chamber 28.

The toner seal member 52 for unsealably sealing the toner supplying opening 27 is constituted by a material compatible with a material for the developing container 23 or a material including an adhesive layer.

The feeding sheet 44 fixed on the rotatable member 45 is formed of a flexible material such as polyethylene terephthalate (PET), polycarbonate (PC) or polyphenylene sulfide (PPS).

As shown in (a) of FIG. 6, an end portion 52a of the toner seal member 52 in a fixing side and an end portion 44a of the feeding sheet 44 in a fixing side are provided with a plurality of through holes 52c and a plurality of through holes 44b, respectively. On the other hand, on a flat surface 45c of the rotatable member 45 from which a part of a circular shape in cross section is cut away, a plurality of projections 45a are provided.

Then, as shown in (a) of FIG. 6, with the projections 45a, the through holes 52a of the toner seal member 52 and the through holes 44b of the feeding sheet 44 are successively engaged. Thereafter, as shown in (b) of FIG. 6, by thermally caulking the projections 45a of the rotatable member 45, the toner seal member 52 and the feeding sheet 44 are integrally fixed to the flat surface 45c of the rotatable member 45.

Incidentally, a method of fixing the toner seal member 52 and the feeding sheet 44 to the rotatable member 45 may also be another fixing method using welding, snap-fitting, double-side tape or the like, and is not necessarily limited.

Further, in this embodiment, the feeding sheet 44 is provided. For example, a constitution in which stirring of the toner T in the toner chamber 29 and feeding of the toner T to the toner supplying chamber 28 are performed by a part of a rotatable member 45 having a long diameter and a short diameter in cross section or a constitution in which the feeding sheet 44 is not provided may also be employed.

The toner seal member 52 is required to have a length in which the toner seal member 52 can cover the toner supplying opening 27 and is mountable on the rotatable member 45. Here, in order to prevent the end portion 52b of the toner seal member 52 from contacting the end portion 44c of the feeding sheet 44 after the toner seal member 52 is unsealed, the feeding sheet 44 and the toner seal member 52 have the same mounting phase. That is, as shown in FIG. 7, a constitution in which the toner seal member 52 was wound along an outer peripheral surface of the rotatable member 45 by rotation of the rotatable member 45 in an arrow S direction of FIG. 7 so as not to contact the end portion 55c of the feeding sheet 44 was employed.

As an example of this embodiment, by peeling the toner seal member 52 from the toner supplying opening 27, movement of the toner T is enabled through the toner supplying opening 27. However, the present invention is not limited thereto, but there is also an example in which the toner seal member 52 is provided with slits. There is also an example in which when the toner seal member 52 is started to be moved by the rotatable member 45, the slits are pulled and torn to cut and unseal the toner seal member 52. In this case, a portion wound up by the rotatable member 45 is a part of the toner seal member 52, and the remaining toner seal member 52 is in a state in which it is bonded to the sealing portion 24.

In this embodiment, the feeding sheet 44 and the toner seal member 52 are fastened together by caulking of the projections 45a. In another example, the feeding sheet 44 and the toner seal member 52 may also be mounted on the rotatable member 45 in different positions.

As shown in (b) of FIG. 6 an open-side end portion 52b side of the toner seal member 52, the toner seal member 52 is peelably fixed to the developing container 23 along an opening edge of the toner supplying opening 27 by the thermal welding or the like. This fixed portion is the sealing portion 24. The toner seal member 52 is connected to the first surface 45c of the rotatable member 45 at its fixing-side end portion 52a in one side via the projections 45a, and is provided with the sealing portion 24, for sealing the toner supplying opening 27, at its end portion 52b in another side.

Here, a forming method of the sealing portion 24 of the toner seal member 52 on the developing container 23 may also be a method other than the thermal welding or the like, and the sealing portion 24 can also be peelably fixed by, e.g., bonding, laser welding or the like.

As shown in FIG. 6, the sealing portion 24 includes sealing portions 24a and 24b as a first sealing portion provided in parallel to a rotational axis direction (axial direction) of the rotatable member 45 along the longitudinal direction of the toner supplying opening 27. The sealing portion 24 further includes sealing portions 24c and 24d as a second sealing portion provided with respect to a direction perpendicular to the rotational axis direction (axial direction) of the rotatable member 45 along a widthwise direction of the toner supplying opening 27.

As shown in FIG. 6, the sealing portions 24a, 24b, 24c and 24d are continuously formed in a rectangular shape at an outer peripheral edge portion of the toner supplying opening 27. As a result, it becomes possible to seal the toner T accommodated in the toner chamber 29.

The sealing portion 24a as a third sealing portion located upstream of the toner supplying opening 27 with respect to the unsealing direction (in a lower side of FIG. 6) is located in the fixing-side end portion 52a side of the toner seal member 52 as seen from the toner supplying opening 27.

On the other hand, the portion 24b as a fourth sealing portion located downstream of the toner supplying opening 27 with respect to the unsealing direction (in an upper side of FIG. 6) is located in the open-side end portion 52a side of the toner seal member 52 as seen from the toner supplying opening 27.

Further, the sealing portion 24c as the second sealing portion is located in the non-driving side, and the sealing portion 24d is located in the driving side.

As shown in (a) of FIG. 8, the toner seal member 52 is loosen between the sealing portion 24 thereof and the through holes 52c thereof. The sealing portion 24a of the toner seal member 52 is peelably fixed on the developing container 23 by the thermal welding or the like. The projections 45a projected from the flat surface 45c of the rotatable member 45 are injected into the through holes 52c of the toner seal member 52.

As a result, even when an external force acts on the rotatable member 45 during assembling and transportation of the cartridge B, the toner seal member 52 is partly loosened and therefore tension is not applied to the toner seal member 52. As a result, a sealing force by the sealing portion 24 is maintained.

<Auxiliary Unsealing Member>

Next, with reference to FIGS. 5, 7 and 8, a structure of an auxiliary unsealing member 100 for changing the pulling direction of the toner seal member 52 by the rotatable member 45 will be described.

As shown in FIGS. 5, 7 and 8, the auxiliary unsealing member 100 is constituted by including a projected shaped portion provided to stand in the neighborhood of the sealing portion 24a on the bottom member 22 constituting the developing frame 1. Incidentally, the auxiliary unsealing member 100 is not required to be constituted integrally with the bottom member 22 but may also be constituted as a separate member.

An end portion 100a of the auxiliary unsealing member 100 contacts and rubs against the toner seal member 52 during the unsealing of the toner seal member 52 shown in FIG. 7. For this reason, in order to prevent catch, the end portion 100a has a moderately curved surface.

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The end portion **100a** of the auxiliary unsealing member **100** in this embodiment is disposed in a position higher than a position of the sealing portion **24a** of the toner seal member **52**. Further, the end portion **100a** is disposed in a position lower than a position of a phantom contact point **45d** where the toner seal member **52** contacts the outer peripheral surface of the rotatable member **45** in a state in which there is no auxiliary unsealing member **100** and the toner seal member **52** is stretched along the first rectilinear line **L1**.

As shown in (a) of FIG. 8, the toner chamber **29** is formed by integrally assembling the developing container **23** with the bottom member **22**. Then, the auxiliary unsealing member **100** is disposed in a projected state in the toner chamber **29**. In this embodiment, the auxiliary unsealing member **100** and the rotatable member **45** as the unsealing member are provided inside the toner chamber **29**. Incidentally, there is no need to provide the auxiliary unsealing member **100** on the bottom member **22**, but the auxiliary unsealing member **100** may also be provided to stand in the neighborhood of the sealing portion **24a** of the developing container **23**.

The auxiliary unsealing member **100** opposes the sealing portion **24a** and is disposed over a substantially full length of the bottom member **22** with respect to the longitudinal direction of the bottom member **22**. Here, a constitution in which the auxiliary unsealing member **100** opposes the sealing portion **24a** and is not disposed over the substantially full length of the bottom member **22** with respect to the longitudinal direction of the bottom member **22** may also be employed. For example, the auxiliary unsealing member **100** may also be provided only in a longitudinal end side of the bottom member **22** or only in longitudinal end sides of the bottom member **22**.

<Arrangement of Sealing Portion of Toner Seal Member, Auxiliary Unsealing Member and Rotatable Member>

In this embodiment, arrangement of the sealing portion **24** of the toner seal member **52**, the auxiliary unsealing member **100** and the rotatable member **45** is shown in FIG. 7. As shown in FIG. 7, a tangential line of the toner seal member **52** which includes the sealing portion **24a** as its end point and which contacts an outer peripheral surface of a rotatable member **45** is a first rectilinear line **L1**. Further, on a rectilinear line passing through the sealing portions **24a** and **24b**, a rectilinear line which includes the sealing portion **24a** as its end point and which extends in a direction opposite from the sealing portion **24b** (in a downward direction of FIG. 7) is a second rectilinear line **L2**. Further, a tangential line of the toner seal member which includes the sealing portion **24a** as its end point and which contacts an outer peripheral surface of the auxiliary unsealing member **100** is a third rectilinear line **L3**.

In this case, as shown by formula 1 below, a narrower angle  $\theta_{12}$  of angles formed between the third rectilinear line **L3** and the second rectilinear line **L2** is set so as to be larger than a narrower angle  $\theta_{11}$  of angles formed between the first rectilinear line **L1** and the second rectilinear line **L2**. The angle  $\theta_{12}$  may preferably be designed so as to approach 180 degrees, and therefore the angle  $\theta_{12}$  may preferably be 120 degrees to 180 degrees.

$$\text{Angle } \theta_{11} < \text{Angle } \theta_{12}$$

(Formula 1)

In order to satisfy a condition represented by formula 1 above, the arrangement of the sealing portion **24** of the toner seal member **52**, the auxiliary unsealing member **100** and the rotatable member **45** is constituted as follows. That is, with respect to the horizontal direction (left-right direction) shown in FIG. 7, the end portion **100a** of the auxiliary unsealing member **100** is disposed between the sealing

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portion **24a** of the toner seal member **52** and the rotatable member **45**. That is, as shown in FIG. 16, with respect to a line **12** perpendicular to a phantom plane **2** including the toner supplying opening **27**, the toner supplying opening **27**, the auxiliary unsealing member **100** and the rotatable member **45** (unsealing member) are disposed in this order from left to right. The auxiliary unsealing member **100** is provided in a position closer to the toner supplying opening **27** than the rotatable member **45** (unsealing member).

Further, as in a comparison example shown in (a) of FIG. 15, a state in which there is no auxiliary unsealing member **100** and the toner seal member **52** is stretched along the first rectilinear line **L1** between the sealing portion **24a** of the toner seal member **52** and the phantom contact point **45d** where the toner seal member **52** contacts the outer peripheral surface of the rotatable member **45** is assumed. In that state, a constitution in which the end portion **100a** of the auxiliary unsealing member **100** is projected upward (in the upward direction of FIG. 7) from the first rectilinear line **L1** connecting the sealing portion **24a** and the phantom contact point **45d** may only be employed.

<Unsealing Operation of Toner Seal Member>

Next, an unsealing operation of the toner seal member **52** performed at the time of start of use of the cartridge B will be described with reference to FIGS. 2, 7 and 8. The cartridge B detachably mountable to the main assembly of the image forming apparatus A is mounted in the main assembly of the image forming apparatus A and receives the driving force from the main assembly of the image forming apparatus A, the rotatable member **45** is rotated in an arrow S direction of (a) of FIG. 8.

When the rotatable member **45** is rotated in the arrow S direction of (a) of FIG. 8, the toner seal member **52** is wound up around the outer peripheral surface of the rotatable member **45**, and as shown in (b) of FIG. 8, tension is applied to the toner seal member **52** in a state in which the toner seal member **52** contacts the end portion **100a** of the auxiliary unsealing member **100** along the outer peripheral surface of the end portion **100a**.

At this time, as shown in FIG. 7, the arrangement of the sealing portion **24** of the toner seal member **52**, the auxiliary unsealing member **100** and the rotatable member **45** is as follows. That is, the narrower angle  $\theta_{12}$  of the angles formed between the third rectilinear line **L3** and the second rectilinear line **L2** is set so as to be larger than the narrower angle  $\theta_{11}$  of the angles formed between the first rectilinear line **L1** and the second rectilinear line **L2**.

At this time, as shown in FIG. 7, an angle formed between a direction in which a peeling force **U** for peeling the sealing portion **24a** of the toner seal member **52** acts and a plane (second rectilinear line **L2**) including the sealing portions **24** (**24a** to **24d**) is  $\theta_{12}$ .

On the other hand, as in the comparison example shown in FIG. 15, the case where the toner seal member **52** is unsealed without providing the auxiliary unsealing member **100** is assumed. In that state, an angle formed between a direction in which a peeling force **U** for peeling the sealing portion **24a** of the toner seal member **52** acts and the plane (second rectilinear line **L2**) including the sealing portions **24** (**24a** to **24d**) is  $\theta_{11}$  (FIG. 7 and (a) of FIG. 15).

Further, as represented by formula 1 above, the condition (Angle  $\theta_{11} < \text{Angle } \theta_{12}$ ) is satisfied. As a result, in the case where the unsealing is effected via the auxiliary unsealing member **100**, the toner seal member **52** can be peeled at the sealing portion **24a** thereof with a smaller peeling force **U** than in the case where the unsealing is effected without providing the auxiliary unsealing member **100**.

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As a result, it is possible to concurrently realize improvement in degree of freedom of the arrangement of the rotatable member 45 and unsealing of the sealing portion 24a of the toner seal member 52 with a low load.

Further, the rotatable member 45 is rotated in the arrow S direction of (b) of FIG. 8. Then, as shown in (c) of FIG. 8, the sealing portion 24a of the toner seal member 52 is peeled. Thereafter, as shown in (d) of FIG. 8, the sealing portions 24c and 24d of the toner seal member 52 are continuously peeled. Finally, the sealing portion 24b of the toner seal member 52 is continuously peeled.

As a result, as shown in FIG. 2, the toner supplying opening 27 is unsealed, and then the toner seal member 52 is rotated together and integrally with the rotatable member 45 in a state in which the toner seal member 52 is wound up along the outer peripheral surface of the rotatable member 45 rotated in the arrow S direction.

As shown in FIG. 2, the end portion 52b of the toner seal member 52 wound up along the outer peripheral surface of the rotatable member 45 is mounted in a length such that the end portion 52b is located downstream of the end portion 44c of the feeding sheet 44 with respect to the rotational direction of the rotatable member 45 rotated in the arrow S direction of FIG. 2. As a result, there is no obstacle to stirring and feeding functions of the toner T by the feeding sheet 44.

By the feeding member 43 including the feeding sheet 44 which is mounted on the rotatable member 45 rotated in the arrow S direction and which is rotated integrally with the rotatable member 45, the toner T in the toner chamber 29 is supplied to the toner supplying chamber 28, where the developing roller 32 is provided, while being stirred.

Incidentally, in this embodiment, an example in which the developing container 23 as the developer accommodating container 23 is provided as a part of the cartridge B which is the process cartridge detachably mountable to the main assembly of the image forming apparatus A was shown. In another example, it is also possible to employ a constitution in which the developing cartridge which is detachably mountable to the main assembly of the image forming apparatus A and which is constituted by providing the developing roller 32 is provided with the developing container 23 as the developer accommodating container.

[Embodiment 2]

Next, with reference to FIG. 9, an image forming apparatus in which a process cartridge also functioning as a developing cartridge including a developer accommodating container according to the present invention in a constitution in this embodiment will be described. Incidentally, constituent elements similar to those in Embodiment 1 described above are represented by the same reference numerals or symbols and will be omitted from description.

In Embodiment 1, as shown in FIG. 7, the example in which the auxiliary unsealing member 100 and the rotatable member 45 as the unsealing member were provided inside the toner chamber 29 was described. In this embodiment, as shown in FIG. 9, the auxiliary unsealing member 100 and the rotatable member 45 as the unsealing member are provided outside the toner chamber 29 and inside the toner supplying chamber 28.

FIG. 9 is a sectional illustration showing a state at the time of start of peeling of the sealing portion 24a of the toner seal member 52 in this embodiment. Also in the constitution in this embodiment shown in FIG. 9, similarly as in Embodiment 1 described above, the toner seal member 52 is wound up around the outer peripheral surface of the rotatable member 45 in a state in which a part of the toner seal

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member 52 is pushed upward by the end portion 100a of the auxiliary unsealing member 100.

In the constitution in this embodiment, a direction in which a peeling force, along the first rectilinear line L1, for peeling the sealing portion 24a of the toner seal member 52 in the case where the toner seal member 52 is wound up in a state in which there is no auxiliary unsealing member 100 acts is assumed. A narrower angle  $\theta 11$  of angles formed between the direction (first rectilinear line L1) and a plane (second rectilinear line L2) including the sealing portions 24 (24a to 24d) is considered.

Further, a direction in which a peeling force U, along the third rectilinear line L3, for peeling the sealing portion 24a of the toner seal member 52 in the case where the toner seal member 52 is wound up in a state in which the auxiliary unsealing member 100 is provided acts is assumed. A narrower angle  $\theta 12$  of angles formed between the direction (third rectilinear line L3) and a plane (second rectilinear line L2) including the sealing portions 24 (24a to 24d) is considered.

In that case, the angle  $\theta 12$  can be made larger than the angle  $\theta 11$ . As a result, similarly as in Embodiment 1, it is possible to peel the toner seal member 52 with a smaller force.

As a result, it becomes possible to concurrently realize improvement in degree of freedom of the arrangement of the rotatable member 45 and unsealing of the toner seal member with a low load. Other constitutions are the same as those in Embodiment 1 described above, and a similar effect can be obtained.

[Embodiment 3]

Next, with reference to FIG. 10, an image forming apparatus in which a process cartridge also functioning as a developing cartridge including a developer accommodating container according to the present invention in a constitution in this embodiment will be described. Incidentally, constituent elements similar to those in the embodiments described above are represented by the same reference numerals or symbols and will be omitted from description.

In the above-described embodiments, a constitution in which the toner T was accommodated directly in the developing container was employed. In this embodiment, a constitution in which a flexible container 300 formed of a flexible material was provided inside the developing container 23 and the toner T was accommodated in the flexible container 300 was employed. Further, the flexible container 300 is provided with the toner supplying opening 27 as an opening in the side toward the toner supplying chamber 28, and the toner seal member 52 for unsealably sealing the toner supplying opening 27 is provided.

In the end portion 52b side, the toner seal member 52 is fixed peelably at an outer peripheral edge portion of the rectangular toner supplying opening 27 of the flexible container 300 by the sealing portions 24 (24a to 24d).

FIG. 10 is a sectional illustration showing a state at the time of start of peeling of the sealing portion 24a of the toner seal member 52 in this embodiment. Also in this embodiment, similarly as in Embodiment 2 described above, the auxiliary unsealing member 100 and the rotatable member 45 as the unsealing member are disposed outside the toner chamber 29 and inside the toner supplying chamber 28.

Further, the toner chamber 29 is formed by bonding the flexible container 300 and a cap member 301, formed of an air-permeable material, to each other, and is fixed to a fixing portion 302 provided at an inner surface of the bottom member 22.

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Also in the constitution in this embodiment shown in FIG. 9, similarly as in the embodiments described above, the toner seal member 52 is wound up around the outer peripheral surface of the rotatable member 45 in a state in which a part of the toner seal member 52 is pushed upward by the end portion 100a of the auxiliary unsealing member 100.

In the constitution in this embodiment, a direction in which a peeling force, along the first rectilinear line L1, for peeling the sealing portion 24a of the toner seal member 52 in the case where the toner seal member 52 is wound up in a state in which there is no auxiliary unsealing member 100 acts is assumed. A narrower angle  $\theta_{11}$  of angles formed between the direction (first rectilinear line L1) and a plane (second rectilinear line L2) including the sealing portions 24 (24a to 24d) is considered.

Further, a direction in which a peeling force U, along the third rectilinear line L3, for peeling the sealing portion 24a of the toner seal member 52 in the case where the toner seal member 52 is wound up in a state in which the auxiliary unsealing member 100 is provided acts is assumed. A narrower angle  $\theta_{12}$  of angles formed between the direction (third rectilinear line L3) and a plane (second rectilinear line L2) including the sealing portions 24 (24a to 24d) is considered.

In that case, the angle  $\theta_{12}$  can be made larger than the angle  $\theta_{11}$ . As a result, similarly as in the above-described embodiments, it is possible to peel the toner seal member 52 with a smaller force.

As a result, it becomes possible to concurrently realize improvement in degree of freedom of the arrangement of the rotatable member 45 and unsealing of the toner seal member with a low load. Other constitutions are the same as those in the embodiments described above, and a similar effect can be obtained.

[Embodiment 4]

Next, with reference to FIGS. 11 and 12, an image forming apparatus in which a process cartridge also functioning as a developing cartridge including a developer accommodating container according to the present invention in a constitution in this embodiment will be described. Incidentally, constituent elements similar to those in the embodiments described above are represented by the same reference numerals or symbols and will be omitted from description.

In the above-described embodiments, the peeling force U at the time of start of peeling of the sealing portion 24a as the third sealing portion located upstream of the toner supplying opening as the opening with respect to the unsealing direction of the toner supplying opening 27 (in the lower side of FIGS. 7, 8, 9 and 10) was reduced by the action of the auxiliary unsealing member 100.

In this embodiment, as shown in (a) and (b) of FIG. 12, a peeling force U at the time of start of peeling of the sealing portion 24a as the third sealing portion located upstream of the toner supplying opening as the opening with respect to the unsealing direction of the toner supplying opening 27 (in the lower side of (a) of FIG. 12) is reduced by the action of the auxiliary unsealing member 100. Further, a peeling force U at the time of start of peeling of the sealing portion 24b as the fourth sealing portion located downstream of the toner supplying opening as the opening with respect to the unsealing direction of the toner supplying opening 27 (in the upper side of (b) of FIG. 12) is reduced by the action of the auxiliary unsealing member 100. As a result, the peeling forces U at the time of start of peeling of the sealing portions 24a and 24b are reduced by the auxiliary unsealing member 100. Such a constitution was employed in this embodiment.

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FIG. 11 is a perspective illustration showing a structure of the bottom member 22 in this embodiment. Part (a) of FIG. 12 is a sectional illustration showing a state at the time of start of peeling of the sealing portion 24a of the toner seal member 52 in this embodiment. Part (b) of FIG. 12 is a sectional illustration showing a state at the time of start of peeling of the sealing portion 24b of the toner seal member 52 in this embodiment.

As shown in FIG. 11, in this embodiment, the auxiliary unsealing member 100 for changing the pulling direction of the toner seal member 52 by the rotatable member 45 as the unsealing member is constituted by including a shaft portion 100b. The shaft portion 100b supported by supporting portions 100c and 100d which are provided to stand at longitudinal end portions of the bottom member 22. As a cross-sectional shape of the shaft portion 100b, other than a cylindrical shape as shown in FIG. 11, a polygonal shape such as a rectangular shape would be considered. Further, the auxiliary unsealing member 100 may also have a structure such as a projected portion in place of the shaft portion 100b extending in the longitudinal direction of the developing container 23 (developer accommodating container).

The toner chamber 29 is formed by integrally assembling the developing container 23 with the bottom member 22. As a result, the auxiliary unsealing member 100 is disposed inside the toner chamber 29.

An end portion 100a of the auxiliary unsealing member 100 in this embodiment is disposed, as shown in (b) of FIG. 12, in a position higher than a position of the sealing portion 24a of the toner seal member 52. Further, the end portion 100a is disposed in a position higher than a position of a phantom contact point 45d where the toner seal member 52 contacts the outer peripheral surface of the rotatable member 45 in a state in which there is no auxiliary unsealing member 100 and the toner seal member 52 is stretched along the fourth rectilinear line L4.

<Arrangement of Sealing Portion of Toner Seal Member, Auxiliary Unsealing Member and Rotatable Member>

In this embodiment, arrangement of the sealing portion 24 of the toner seal member 52, the auxiliary unsealing member 100 and the rotatable member 45 is shown in (a) and (b) of FIG. 12. As shown in (a) of FIG. 12, a tangential line of the toner seal member 52 which includes the sealing portion 24a as its end point and which contacts an outer peripheral surface of a rotatable member 45 is a first rectilinear line L1. Further, on a rectilinear line passing through the sealing portions 24a and 24b, a rectilinear line which includes the sealing portion 24a as its end point and which extends in a direction opposite from the sealing portion 24b (in a downward direction of (a) of FIG. 12) is a second rectilinear line L2. Further, a tangential line of the toner seal member which includes the sealing portion 24a as its end point and which contacts an outer peripheral surface of the shaft portion 100b of the auxiliary unsealing member 100 is a third rectilinear line L3.

In this case, as shown by formula 1 described above, a narrower angle  $\theta_{12}$  of angles formed between the third rectilinear line L3 and the second rectilinear line L2 is set so as to be larger than a narrower angle  $\theta_{11}$  of angles formed between the first rectilinear line L1 and the second rectilinear line L2. Further, as shown in (b) of FIG. 12, a tangential line of the toner seal member 52 which includes the sealing portion 24b as its end point and which contacts an outer peripheral surface of a rotatable member 45 is a fourth rectilinear line L4. The sealing portion 24b is the fourth sealing portion disposed downstream of the toner supplying opening 27 as the opening (in the upper side of (b) of FIG.



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12). Further, on a rectilinear line passing through the sealing portions 24a and 24b, a rectilinear line which includes the sealing portion 24b as its end point and which passes through the sealing portion 24a is a fifth rectilinear line L5. The sealing portion 24a is the third sealing portion disposed upstream of the toner supplying opening 27 as the opening (in the lower side of (b) of FIG. 12). Further, a tangential line of the toner seal member 52 which includes the sealing portion 24b as its end point and which contacts an outer peripheral surface of the shaft portion 100b of the auxiliary unsealing member 100 is a sixth rectilinear line L6.

In this case, as shown by formula 2 below, a narrower angle  $\theta 22$  of the angles formed between the fifth rectilinear line L5 and the sixth rectilinear line L6 is set so as to be larger than a narrower angle  $\theta 21$  of angles formed between the fourth rectilinear line L4 and the fifth rectilinear line L5.

$$\text{Angle } \theta 21 < \text{Angle } \theta 22$$

(Formula 2)

In order to satisfy a condition represented by formula 2 above, the arrangement of the sealing portion 24 of the toner seal member 52, the auxiliary unsealing member 100 and the rotatable member 45 is constituted as follows. That is, with respect to the horizontal direction (left-right direction) shown in FIG. 12, the shaft portion 100b of the auxiliary unsealing member 100 is disposed between the sealing portions 24a and 24b (as the sealing portion 24) of the toner seal member 52 and the rotatable member 45.

Further, a state in which there is no auxiliary unsealing member 100 and the toner seal member 52 is stretched along the fourth rectilinear line L4, shown in (b) of FIG. 12, between the sealing portion 24b of the toner seal member 52 and the phantom contact point 45d where the toner seal member 52 contacts the outer peripheral surface of the rotatable member 45 is assumed. In that state, a constitution in which a top end surface 100e of the shaft portion 100b of the auxiliary unsealing member 100 is projected upward (in the upward direction of (b) of FIG. 12) from the fourth rectilinear line L4 connecting the sealing portion 24b and the phantom contact point 45d may only be employed.

<Unsealing Operation of Toner Seal Member>

Next, a peeling unsealing operation of the sealing portions 24a and 24b of the toner seal member 52 will be described with reference to (a) and (b) of FIG. 12.

As shown in (a) of FIG. 12, during peeling of the sealing portion 24a, the pulling direction of the toner seal member 52 by the rotatable member 45 is controlled by the top end surface 100e of the shaft portion 100b of the auxiliary unsealing member 100 so as to satisfy the condition (Angle  $\theta 11 < \text{Angle } \theta 12$ ) represented by the above-described formula 1.

As a result, with respect to the peeling of the sealing portion 24a, in the case where the unsealing is effected via the auxiliary unsealing member 100, the sealing portion 24a of the toner seal member 52 can be peeled with a smaller peeling force U than in the case where the unsealing is effected without providing the auxiliary unsealing member 100.

Next, the peeling operation of the sealing portion 24b will be described with reference to (b) of FIG. 12. In the case where the sealing portion 24b of the toner seal member 52 is unsealed without providing the auxiliary unsealing member 100, a direction in which the peeling force U acts is a direction along the fourth rectilinear line L4 shown in (b) of FIG. 12. In this case, an angle formed between the acting direction of the peeling force U (the direction along the fourth rectilinear line L4) and a plane (the direction along

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the fifth rectilinear line L5) including the sealing portions 24 (24a to 24d) is shown by  $\theta 21$ .

As shown in (b) of FIG. 12, during peeling of the sealing portion 24b, the pulling direction of the toner seal member 52 by the rotatable member 45 is controlled by the top end surface 100e of the shaft portion 100b of the auxiliary unsealing member 100 so as to satisfy the condition (Angle  $\theta 21 < \text{Angle } \theta 22$ ) represented by the above-described formula 2.

As a result, with respect to the peeling of the sealing portion 24b, in the case where the unsealing is effected via the auxiliary unsealing member 100, the sealing portion 24b of the toner seal member 52 can be peeled with a smaller peeling force U than in the case where the unsealing is effected without providing the auxiliary unsealing member 100.

In this embodiment, with respect to not only the sealing portions 24a and 24b but also the sealing portions 24c and 24d which are continuously located between these sealing portions 24a and 24b with respect to a direction perpendicular to the rotational axis direction of the rotatable member 45, the auxiliary unsealing member 100 is similarly provided. As a result, the toner seal member 52 can be peeled with a smaller peeling force U. That is, at the entire sealing portion 24, it is possible to peel the toner seal member 52 with the smaller peeling force U.

As a result, it becomes possible to concurrently realize improvement in degree of freedom of the arrangement of the rotatable member 45 and unsealing of the toner seal member with a low load. Other constitutions are the same as those in the embodiments described above, and a similar effect can be obtained.

[Embodiment 5]

Next, with reference to FIG. 13, an image forming apparatus in which a process cartridge also functioning as a developing cartridge including a developer accommodating container according to the present invention in a constitution in this embodiment will be described. Incidentally, constituent elements similar to those in the embodiments described above are represented by the same reference numerals or symbols and will be omitted from description.

In Embodiment 4, the constitution in which the toner seal member 52, the sealing portion 24, the auxiliary unsealing member 100 and the rotatable member 45 were provided inside the toner chamber 29 was employed. In this embodiment, a constitution in which the toner seal member 52, the sealing portion 24, the auxiliary unsealing member 100 and the rotatable member 45 are provided outside the toner chamber 29 and inside the toner supplying chamber 28 is employed.

Part (a) of FIG. 13 is a sectional illustration showing a state at the time of start of peeling of the sealing portion 24a of the toner seal member 52.

Part (b) of FIG. 13 is a sectional illustration showing a state at the time of start of peeling of the sealing portion 24b of the toner seal member 52.

Also in the constitution in this embodiment, similarly as in Embodiment 4 described above, the toner seal member 52 is wound up by the rotatable member 45 via the auxiliary unsealing member 100.

As a result, it is possible to peel the toner seal member 52 with a smaller peeling force U than in the case where the toner seal member 52 is wound up by the rotatable member 45 in a state in which there is no auxiliary unsealing member 100.

As a result, it becomes possible to concurrently realize improvement in degree of freedom of the arrangement of the

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rotatable member **45** and unsealing of the toner seal member with a low load. Other constitutions are the same as those in the embodiments described above, and a similar effect can be obtained.

[Embodiment 6]

Next, with reference to FIG. **14q**, an image forming apparatus in which a process cartridge also functioning as a developing cartridge including a developer accommodating container according to the present invention in a constitution in this embodiment will be described. Incidentally, constituent elements similar to those in the embodiments described above are represented by the same reference numerals or symbols and will be omitted from description.

In the above-described Embodiment 5, a constitution in which the toner **T** was accommodated directly in the developing container was employed. In this embodiment, similarly as in the above-described Embodiment 3, a constitution in which a flexible container **300** formed of a flexible material was provided inside the developing container **23** and the toner **T** was accommodated in the flexible container **300** was employed. Further, the flexible container **300** is provided with the toner supplying opening **27** as an opening in the side toward the toner supplying chamber **28**, and the toner seal member **52** for unsealably sealing the toner supplying opening **27** is provided. Other portions or members are constituted similarly as in the above-described Embodiment 5.

Part (a) of FIG. **14** is a sectional illustration showing a state at the time of start of peeling of the sealing portion **24a** of the toner seal member **52**.

Part (b) of FIG. **14** is a sectional illustration showing a state at the time of start of peeling of the sealing portion **24b** of the toner seal member **52**.

As shown in FIG. **14**, the toner chamber **29** is formed by bonding the flexible container **300**, formed of the flexible material, and a cap member **301**, formed of an air-permeable material, to each other. The toner chamber **29** is fixed by a fixing portion **302** provided at an inner peripheral surface of the bottom member **22**.

Also in the constitution in this embodiment, by winding up the toner seal member **52** by the rotatable member **45** via the auxiliary unsealing member **100**, it is possible to peel the toner seal member **52** with a smaller peeling force **U** than in the case where the toner seal member **52** is wound up by the rotatable member **45** in a state in which there is no auxiliary unsealing member **100**.

As a result, it becomes possible to concurrently realize improvement in degree of freedom of the arrangement of the rotatable member **45** and unsealing of the toner seal member with a low load. Other constitutions are the same as those in the embodiments described above, and a similar effect can be obtained.

According to the above-described constitutions of the present invention, by providing the auxiliary unsealing member, it is possible to improve the degree of freedom of the arrangement of the unsealing member.

While the invention has been described with reference to the structures disclosed herein, it is not confined to the details set forth and this application is intended to cover such modifications or changes as may come within the purpose of the improvements or the scope of the following claims.

This application claims priority from Japanese Patent Application No. 213799/2012 filed Sep. 27, 2012, which is hereby incorporated by reference.

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What is claimed is:

**1.** A developer container for accommodating developer, said developer container comprising:

a seal member for unsealably sealing an opening of said developer container;

an unsealing member, connected to an end portion of said seal member, for unsealing the opening; and

an auxiliary unsealing member for assisting unsealing by changing a pulling direction of said seal member by said unsealing member,

wherein said auxiliary unsealing member includes a shaft portion or a projected portion,

wherein said shaft portion or said projected portion extends in a longitudinal direction of said developer container, and

wherein a feeding sheet is fixed on said unsealing member, and said seal member is fixed between said feeding sheet and said unsealing member.

**2.** A developer container according to claim **1**, wherein said auxiliary unsealing member is provided in a position closer to the opening than said unsealing member.

**3.** A developer container according to claim **1**, wherein the opening, said unsealing member, and said auxiliary unsealing member are provided in this order with respect to a line perpendicular to a phantom surface including the opening.

**4.** A developer container according to claim **1**, wherein said unsealing member is constituted by a rotatable member capable of stirring the developer.

**5.** A developer container according to claim **1**, wherein said auxiliary unsealing member and said unsealing member are provided inside of a toner chamber of said developer container.

**6.** A developing cartridge detachably mountable to a main assembly of an image forming apparatus, said developing cartridge comprising:

a developer container according to claim **1**; and

a developer carrying member for supplying developer in said developer container to a surface of an image bearing member on which an electrostatic latent image is to be formed.

**7.** A process cartridge detachably mountable to a main assembly of an image forming apparatus, said process cartridge comprising:

a developer container according to claim **1**;

an image bearing member on which an electrostatic latent image is to be formed; and

a developer carrying member for supplying developer in said developer container to a surface of said image bearing member.

**8.** An image forming apparatus for forming an image on a sheet, said image forming apparatus comprising:

a developing cartridge according to claim **6**, wherein said developing cartridge is detachably mountable to said image forming apparatus.

**9.** An image forming apparatus for forming an image on a sheet, said image forming apparatus comprising:

a process cartridge according to claim **7**, wherein said process cartridge is detachably mountable to said image forming apparatus.

**10.** A developer container according to claim **1**,

wherein said seal member is connected to said unsealing member in a side thereof and includes, in another side thereof, a sealing portion for sealing the opening,

wherein said sealing portion includes a first sealing portion provided in parallel to an axial direction of said unsealing member and a second sealing portion pro-

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vided with respect to a direction perpendicular to the axial direction of the unsealing member,

wherein said first sealing portion includes a third sealing portion located in an upstream side of the opening and a fourth sealing portion located in a downstream side of the opening with respect to the rotation of said unsealing member,

wherein, when a tangential line of said seal member which includes said third sealing portion as its end point and which contacts an outer peripheral surface of said unsealing member is a first rectilinear line, a rectilinear line that is on a rectilinear line passing through said third sealing portion and said fourth sealing portion and which extends from said third sealing portion as its end point in a direction opposite from said fourth sealing portion is a second rectilinear line, and a tangential line of said seal member which includes said third sealing portion as its end point and which contacts an outer peripheral surface of said auxiliary unsealing member is a third rectilinear line, a narrower angle of angles formed between the third rectilinear line and the second rectilinear line is larger than a narrower angle of angles formed between the first rectilinear line and the second rectilinear line, and wherein the first, second, and third lines are defined in a plane crossing an axial direction of said unsealing member.

11. A developer container according to claim 1, wherein said seal member includes an upper sealing portion located in an upper side of the opening and a lower sealing portion located in a lower side of the opening, and

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wherein, if a first line that connects said lower sealing portion and an outer peripheral surface of said unsealing member, a second line that connects said upper sealing portion and said lower sealing portion, and a third line that connects said lower sealing portion and an outer peripheral surface of said auxiliary unsealing member are defined, a narrower angle of angles formed between the third line and the second line is smaller than a narrower angle of angles formed between the first line and the second line.

12. A developer container according to claim 1, wherein said auxiliary unsealing member is positioned below said unsealing member.

13. A developer container according to claim 1, wherein said auxiliary unsealing member is positioned below the opening.

14. A developer container according to claim 1, wherein said auxiliary unsealing member is positioned above a lower end of said unsealing member in a state in which a cartridge including said developer container is mounted in a main assembly of an image forming apparatus.

15. A developer container according to claim 1, wherein said auxiliary unsealing member includes a projected portion that projects from a bottom member of said developer container,

wherein said projected portion is located below an axis of said unsealing member.

16. A developer container according to claim 1, wherein said auxiliary unsealing member includes a shaft portion which extends in a longitudinal direction of said developer container and which does not rotate.

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